U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

Historic document – Content may not reflect current scientific research, policies or practices.

Blank Page Digitally Inserted

WATERFOWL POPULATIONS and BREEDING CONDITIONS Summer 1950 - With Notes on Woodcock and Wilson's Snipe

FISH AND WILDLIFE SERVICE
FEB
WILDLIFE
DENVER, COLO.

LIBRARY, WILDLIFE RESEARCH CENTER
U.S. FISH & WILDLIFE SERVICE
BLDG. 16. FEDERAL CENTER
DENVER, COLORADO 80225

SPECIAL SCIENTIFIC REPORT: WILDLIFE No. 8

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
CANADA DEPARTMENT OF RESOURCES AND DEVELOPMENT
CANADIAN WILDLIFE SERVICE

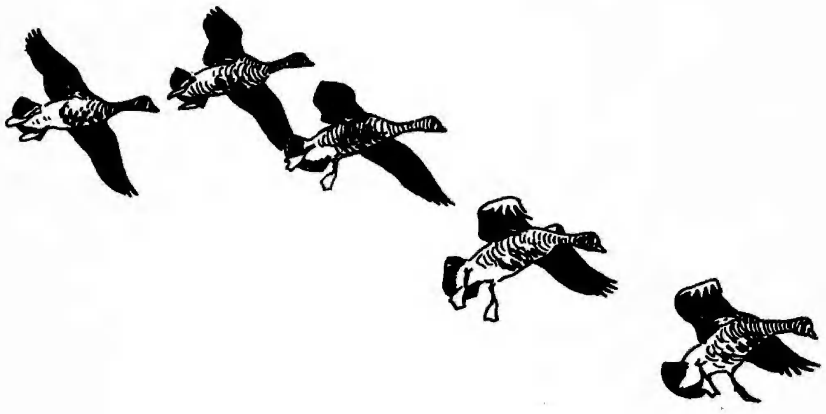
Blank Page Digitally Inserted

WATERFOWL POPULATIONS AND BREEDING CONDITIONS - SUMMER 1950

With Notes on Woodcock and Wilson Snipe

by

C. S. Williams and others



Special Scientific Report Wildlife No. 8

United States Department of the Interior ..... Oscar L. Chapman, Secretary
Fish and Wildlife Service ..... Albert M. Day, Director

Canadian Department of Resources and Development . Hon. R. H. Winters, Minister
Canadian Wildlife Service..... Harrison F. Lewis, Chief

Blank Page Digitally Inserted

TABLE OF CONTENTS

	Page
Introduction by C. S. Williams, Chief, Section of Waterfowl Management Investigations, U. S. Fish and Wildlife Service	1
Waterfowl Breeding Ground Survey in Alaska, 1950 by Urban C. Nelson, Alaska Federal Aid	3
Waterfowl Breeding Ground Survey in Northern Alberta, Yukon, and the Northwest Territories, 1950 by Robert H. Smith, Flyway Biologist, and C. F. Safranek, Collaborator, U. S. Fish and Wildlife Service	8
A Waterfowl Reconnaissance in the James Bay-Hudson Bay Region by A. S. Hawkins, E. G. Wellein, Flyway Biologists and W. F. Crissey, Assistant Chief, Section of Waterfowl Management Investigations, U. S. Fish and Wildlife Service	17
Waterfowl Breeding Conditions in British Columbia, 1950 by David A. Munro and R. H. Mackay, Canadian Wildlife Service	23
Waterfowl Breeding Ground Survey in Alberta, 1950 by Allen G. Smith, Flyway Biologist, U. S. Fish and Wildlife Service	29
Waterfowl Breeding Ground Survey in Saskatchewan, 1950 by D. G. Colls, Dominion Wildlife Officer, Canadian Wildlife Service	36
Waterfowl Breeding Ground Survey in Manitoba, 1950 by Arthur S. Hawkins, Flyway Biologist, U. S. Fish and Wildlife Service	41
Waterfowl Breeding Ground Survey by Manitoba Game Branch Officers, 1950 by E. N. Cole, Manitoba Game Branch	49
Waterfowl Breeding Population and Production in Manitoba Inventory District No. 8, by William H. Kiel, Jr., Collaborator, U. S. Fish and Wildlife Service	52
Waterfowl Investigations at Whitewater Lake, Manitoba, 1950 by Eugene F. Bossenmaier, Collaborator, U. S. Fish and Wildlife Service	55
Notes on the Chronology of the 1950 Waterfowl Nesting Season in Southern Manitoba by Lyle K. Sowls, Biologist, Wildlife Management Institute	59
Waterfowl Breeding Ground Survey in Ontario, 1950 by Arthur S. Hawkins, U. S. Fish and Wildlife Service	62
Waterfowl Survey in Northwestern Ontario, 1950 by Lester W. Gray, Fish and Wildlife Division, Ontario Department of Lands and Forests	65
Waterfowl Observations in the Cochrane District of Ontario, 1950 by Charles O. Bartlett, Fish and Wildlife Division, Ontario Department of Lands and Forests	68
Waterfowl Breeding Ground Survey in Quebec and Eastern Ontario, 1950 by John S. Tener, Canadian Wildlife Service	74

Page

Waterfowl Breeding Ground Surveys in Eastern Canada, 1950 by C. E. Addy, L. D. Cool, U. S. Fish and Wildlife Service and G. F. Boyer, H. R. Webster, R. Mosher, Canadian Wildlife Service 80

Waterfowl Breeding Ground Survey in Newfoundland, 1950 by Leslie M. Tuck, Canadian Wildlife Service. 85

Waterfowl Breeding Ground Survey in the St. John Estuary, New Brunswick, 1950 by Brian C. Carter, Biologist, Northeastern Wildlife Station, Wildlife Management Institute 87

Observations of Summering Concentrations of Black Ducks on the Grand Pré-Canard Areas of Nova Scotia, 1950 by Ralph Mosher, Canadian Wildlife Service. 90

Waterfowl Breeding Ground Survey in Washington, 1950 by Henry A. Hansen, Wendell H. Oliver, and Robert G. Jeffrey, Washington State Federal Aid. 94

Waterfowl Breeding Ground Survey in Oregon, 1950 by William B. Morse, Oregon State Federal Aid 104

Waterfowl Breeding Ground Survey in California, 1950 by John E. Chattin, A. W. Miller, and J. A. Blaisdell, California State Federal Aid 110

Waterfowl Breeding Ground Survey in Nevada, 1950 by Fred E. Wright, Nevada State Federal Aid 118

Waterfowl Breeding Ground Survey in Idaho, 1950 by Robert L. Salter, Idaho State Federal Aid 126

Waterfowl Production at Gray's Lake, Idaho, 1950 by Elwood G. Bizeau and Paul E. Steel, Idaho Cooperative Wildlife Research Unit 128

Waterfowl Breeding Ground Surveys in Utah, 1950 by Noland F. Nelson, Utah State Federal Aid 135

Waterfowl Breeding Ground Surveys in Montana, 1950 by Wynn G. Freeman and Gerald Salinas, Montana State Federal Aid 137

Waterfowl Breeding Ground Survey in North Dakota, 1950 by Brandt V. Hjelle, North Dakota State Federal Aid 143

Waterfowl Breeding Ground Survey in South Dakota, 1950 by Ray Murdy 147

Waterfowl Breeding Ground Survey in the Dakotas, 1950 by Jerome H. Stoudt, Flyway Biologist, U. S. Fish and Wildlife Service 153

Waterfowl Breeding Ground Survey in Colorado, 1950 by Willard L. Flinn, Colorado State Game and Fish Department 162

Waterfowl Breeding Ground Survey in Nebraska, 1950 by John H. Wampole, Nebraska State Federal Aid. 165

Page

Aerial Waterfowl Breeding Ground Surveys in North Dakota, South Dakota, and Nebraska, 1950 by Edward G. Wellein, Flyway Biologist, U. S. Fish and Wildlife Service 172

Waterfowl Breeding Ground Survey in Minnesota, 1950 by Forrest B. Lee, Minnesota State Federal Aid 176

Waterfowl Breeding Ground Surveys, 1937 to 1950, Chippewa National Forest, Minnesota, by Jerome H. Stoudt, Flyway Biologist, U. S. Fish and Wildlife Service 183

Waterfowl Breeding Ground Survey in Iowa, 1950 by James G. Sieh, Iowa State Federal Aid 187

Waterfowl Breeding Ground Survey in Wisconsin, 1950 by R. C. Hopkins, F. A. Hartmeister, R. W. Mihalek, L. R. Jahn, and W. M. Kitz, Wisconsin State Federal Aid 194

Waterfowl Breeding Ground Survey in Michigan, 1950 by Herbert J. Miller, Michigan Conservation Commission 203

Waterfowl Breeding Ground Survey in Indiana, 1950 by Russell E. Mumford, Indiana Conservation Department. 206

Waterfowl Breeding Ground Survey in Ohio, 1950 by John M. Anderson, Game Technician, Lake Erie Waterfowl Clubs, Port Clinton, Ohio . . 215

Waterfowl Breeding Ground Survey in Northeastern States, 1950 by C. E. Addy, Flyway Biologist, U. S. Fish and Wildlife Service . . . 217

Waterfowl Breeding Ground Survey in Maine, 1950 by Howard L. Mendall, Leader, Maine Cooperative Wildlife Research Unit. 221

Waterfowl Breeding Ground Survey in New Hampshire, 1949 and 1950 by Tudor Richards 224

Waterfowl Breeding Ground Survey in Delaware, 1950 by E. B. Chamberlain, Delaware State Federal Aid. 231

Waterfowl Nesting Season on National Waterfowl Refuges, 1950 by Richard E. Griffith, Chief, Habitat Improvement, U. S. Fish and Wildlife Service 235

Woodcock Census Studies in Northeastern United States, 1950 by Howard L. Mendall, Leader, Maine Cooperative Wildlife Research Unit 241

Woodcock Singing Ground Counts in Eastern Canada, 1950 by Victor E. F. Solman, Canadian Wildlife Service 247

Wilson's Snipe Singing Ground Counts in Eastern Canada by Victor E. F. Solman, Canadian Wildlife Service 250

Errata. 252

Blank Page Digitally Inserted

INTRODUCTION

C. S. Williams

One of the outstanding events in the wildlife field in recent years has been the collaboration of waterfowl workers to get facts about waterfowl breeding populations and the pooling of those facts to the benefit of hunting regulations. This cooperative effort has grown from an increasing recognition by the men and their respective agencies that the results of local investigations of migratory waterfowl and their habitats (1) normally cannot be projected to apply to other parts of the breeding range, and (2) attain their greatest management value when they are considered in the light of similar information from other areas and become a part of a broad picture of conditions.

The summer of 1947 saw the first widespread attempt to get cooperative waterfowl breeding ground investigations under way. Flyway Biologists of the United States and Canadian Wildlife Officers that year undertook aerial and ground surveys of the important breeding grounds in southern Alberta, Saskatchewan, and Manitoba. The flyway men also sampled portions of the Dakotas and Minnesota. In addition, the results of individual investigations were received from some National Wildlife Refuges, the Maine Cooperative Wildlife Research Unit, and the Wildlife Management Institute's wildlife station in New Brunswick.

That was a start, but the coverage, important as it was, actually involved only a small part of the breeding range. Since 1947, however, the cooperative breeding ground investigations have come a long way, achieving results which could not have been obtained by any other means.

In contrast to 1947, the 1950 waterfowl breeding season saw workers getting management facts in Alaska, the Northwest Territories, the James and Hudson Bay areas, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Maritime Provinces, Newfoundland, Washington, Oregon, California, Montana, Idaho, Utah, Nevada, North Dakota, South Dakota, Colorado, Nebraska, Minnesota, Wisconsin, Iowa, Michigan, Ohio, Indiana, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, Delaware, New York, Pennsylvania, New Jersey, and Maryland.

In 1950, the Fish and Wildlife Service had 6 aircraft and 15 men assigned to work in Canada with personnel of the Provincial Game Branches and the Canadian Wildlife Service. In the 28 States from which breeding ground information was received, most of the studies were conducted by State technicians operating under Federal Aid or Cooperative Wildlife Research Units. Not to be overlooked, however, were the contributions of individual cooperators in Ohio and the northeastern States.

Broadly stated, the idea behind cooperative breeding ground surveys is to supply the regulation committees of Canada and the United States with information of a type which would best assure hunting regulations that conformed to the relative abundance of ducks and geese in the several major flyways. This involves getting appraisals of breeding population and production trends by the time the regulatory bodies meet.

In the United States, regulation meetings this year were delayed approximately one month or until early August. This permitted a better appraisal of conditions on the various breeding areas and thus provided more accurate information on which to

base decisions. In Canada, Provincial and Dominion authorities received summaries of the breeding population data which had been obtained up to a few days before the Canadian regulation conference in June. The Canadian workers, however, continued with the investigations after their regulations had been discussed, as not only are full reports of the season invaluable to long-time management but sound regulations in the United States also benefit Canadians.

Since the Regulation and Advisory Board Committees in the United States were to meet during the first week in August, July 29 was set as the deadline date for the breeding ground reports to reach Washington. As the various reports were received, they were carefully reviewed and the pertinent information was extracted to give as clear an idea as possible of conditions in the different sections of the breeding range. The data were then considered in the light of known distribution of birds from each area to the four major flyways. This information, along with maps indicating the coverage and the general results in each section, was discussed in the several committees. After the committee meetings, a brief digest of the reports was distributed to State Game Departments, along with the Regulation Committee's recommendations.

The summary for the regulation group, of course, could not present as adequate a picture of conditions in the many breeding areas as the reports contained in this compilation. Also, it could not hope to do justice to the fine work that had been done in the field nor give full credit where it was due. Yet the summary of the data submitted by the many men scattered over the breeding grounds had a pronounced influence on the regulations. To all those who assisted with the cooperative studies, there should come the satisfaction of knowing that the waterfowl regulations were better because of their joint effort.

If the areas on which cooperative surveys were made this year were spotted on a map, it would become apparent that most of the breeding grounds of known importance on the continent were sampled. Despite this extension of coverage and the progress which has been made since 1947, there still remains much to be done. More exploratory work in the Far North is needed to judge the relative value of the available areas to production. The wrinkles in aerial and ground survey techniques must be ironed out and a common denominator found by which the results from one section can be added better to those of another. Additional tests must be made on current methods to determine the size of samples needed to represent conditions adequately. More birds of the different species must be banded each year on the breeding grounds prior to the opening of shooting seasons, so that species' flyways will be more clearly outlined and hunting pressure indices be made available. These and other related problems will test the ingenuity of waterfowl workers. It may not be possible for us to come up with annual estimates of production for the several flyways, but in striving together for this goal, Provincial, State, and Federal administrators can be supplied with the best criteria available for regulating hunting seasons and bag limits. The data in the following reports emphasize this.

WATERFOWL BREEDING GROUND SURVEY IN ALASKA - 1950

Urban C. Nelson

Personnel taking part in the field work and preparing reports which are included herein: W. A. Elkins, Wildlife Management Supervisor; D. L. Spencer, Refuge Supervisor; Edward F. Chatelain and Robert F. Scott, Assistant Leaders Federal Aid; Raymond Woolford, Robert Baker, Robert F. Smith, Enforcement Agents; Dr. Neil W. Hosley, Leader Cooperative Research Unit; and M. W. Kelly, District Agent Predator Control.

Introduction

This year the waterfowl surveys were conducted for the purpose of (1) securing quantitative information on waterfowl abundance in certain key areas for comparison with populations in previous years, (2) broadening the waterfowl knowledge of a few heretofore unchecked areas, (3) banding a large enough sample of waterfowl in North America's greatest black brant and cackling goose nesting grounds (Yukon Delta) to complete the migration pattern to and from these grounds, and (4) to continue on the third year of banding on the Innoko River.

Last year Scott flew transects on the Innoko River, Lower Yukon and Kotzebue Sound areas and banded on the Buckland River. Spencer flew the transects on the Yukon - Kuskokwim Delta and with Chatelain banded there and on the Innoko. Nelson and Woolford flew the Arctic Coast transects in June and Nelson banded there during July.

This year Scott repeated the Innoko, Lower Yukon, and Kotzebue Sound areas and with Baker flew additional transects on the north coast of the Seward Peninsula. Woolford flew the Arctic Coast transects and the Minto Lakes area. Spencer, Chatelain, and Kelly flew the transects on the Lower Yukon and Kuskokwim Deltas.

Hosley banded on the Minto Lakes; Phillip Edwards on the Innoko; and Elkins, Nelson, Chatelain, and Smith on the Kashunuk and Hazen - Hooper Bay areas. A few birds were also banded at Juneau and Cold Bay, on the Stikine River, and St. Lawrence Island. Local native assistants were employed to help.

Methods Used in Sampling, and Area Covered

Waterfowl counts were made on aerial transects comparable to the 1949 surveys. Both "flight route" and random transects were used.

The flight route transects were laid out usually between landmarks visible from the air or on a bearing from a single landmark. They provide a proper distribution of the sample over the entire area; distances are measured on the map. Random transects were flown in a "U" pattern up and down wind which permits determining true distances from the air speed. The random transects are flown in conjunction with the flight routes and can be used to fill in "holes" in the sample, to compensate for weather or time interference with flight routes. Often landmarks are not adequate, pilots or observers become fatigued or eye strain develops and the random transect provides a break or rest, thereby having an advantage over the monotonous flight route transect.

In addition to the waterfowl areas flown in 1949, reconnaissance transects were flown in the Minto Lakes area and on the north coast of the Seward Peninsula. The 1950 surveys were the most extensive waterfowl surveys ever made in Alaska and yet there are vast areas with both high and low waterfowl populations that were untouched. The Copper River and Fort Yukon flats, as well as hundreds of small river delta areas on the coast, should be included in future years.

Innoko, Lower Yukon and Kotzebue Sound

These areas were covered by Scott piloting a Stinson Station Wagon on floats which cruised at 90 - 100 miles per hour. The Seward Peninsula transects were flown in a Stinson AT - 19 on wheels, with Baker as pilot. A total of 50 hours flying time was expended.

Lower Yukon and Kuskokwim Delta

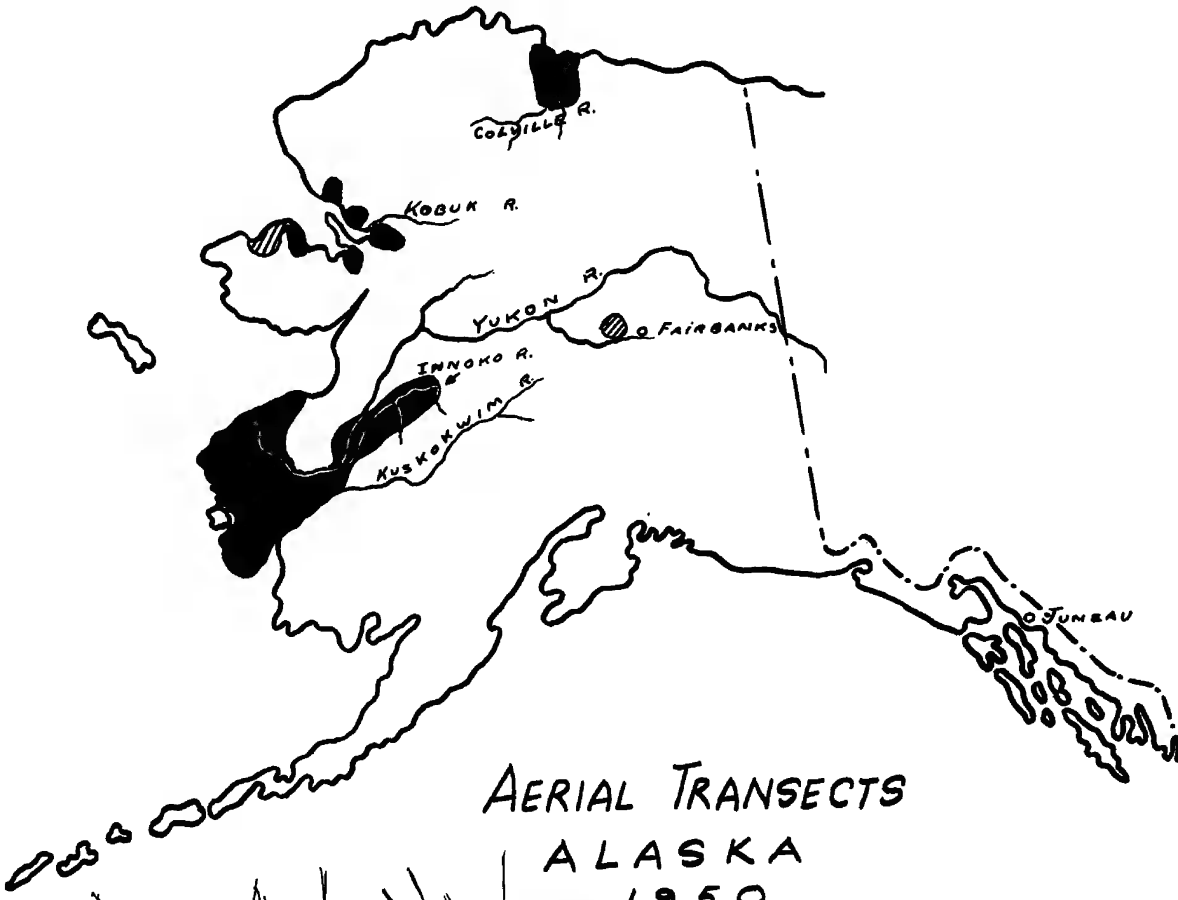
Spencer, Chatelain, and Kelly covered the lower Yukon - Kuskokwim Delta using a Grumman Widgeon cruising 105 - 115 miles per hour.

Arctic Coast, Minto Lakes

Woolford, with Dr. Ira N. Gabrielson as observer, flew the transects in these areas using the L-1 Stinson on floats.

The spring break-up in 1950 was near normal but two weeks earlier than in 1949. The lower Yukon Valley maintained water levels lower than in the two preceding years and consequently many large nesting areas were undisturbed by high water. Mild weather prevailed during the summer. No severe storms were reported on the important coastal nesting areas.

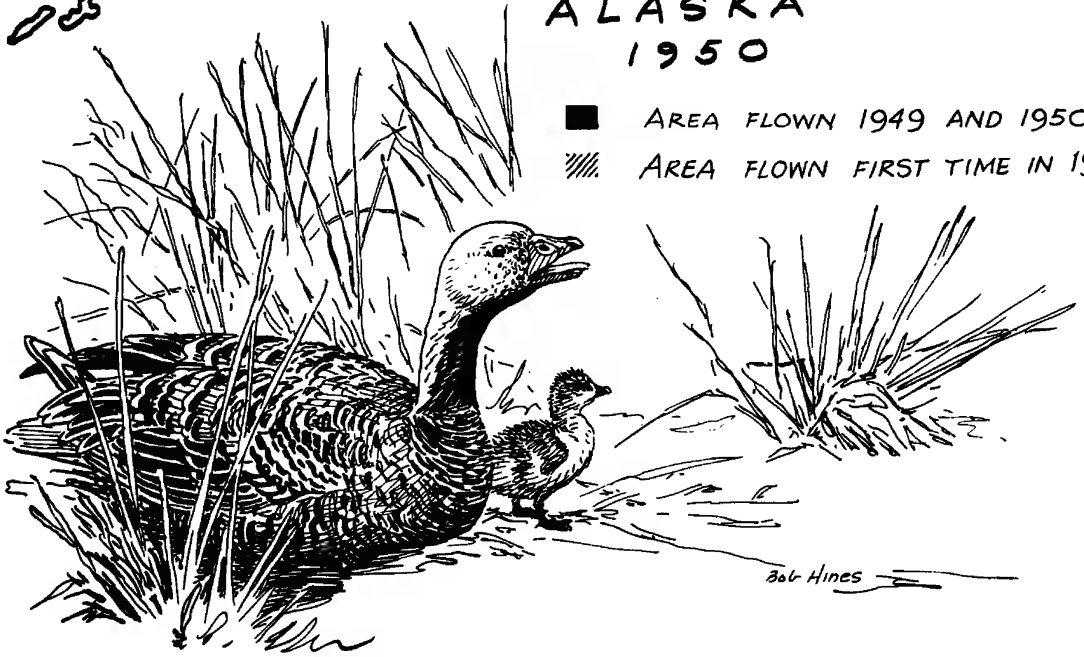
The data from aerial transects show no significant change in the number of waterfowl from 1949. No abnormal factors are known to have affected the nesting season and observations on number and size of broods indicate no change from normal years. Brood counts were limited to observations made during banding operations on the Hooper - Hazen areas on the Yukon Delta.



AERIAL TRANSECTS
ALASKA
1950

■ AREA FLOWN 1949 AND 1950

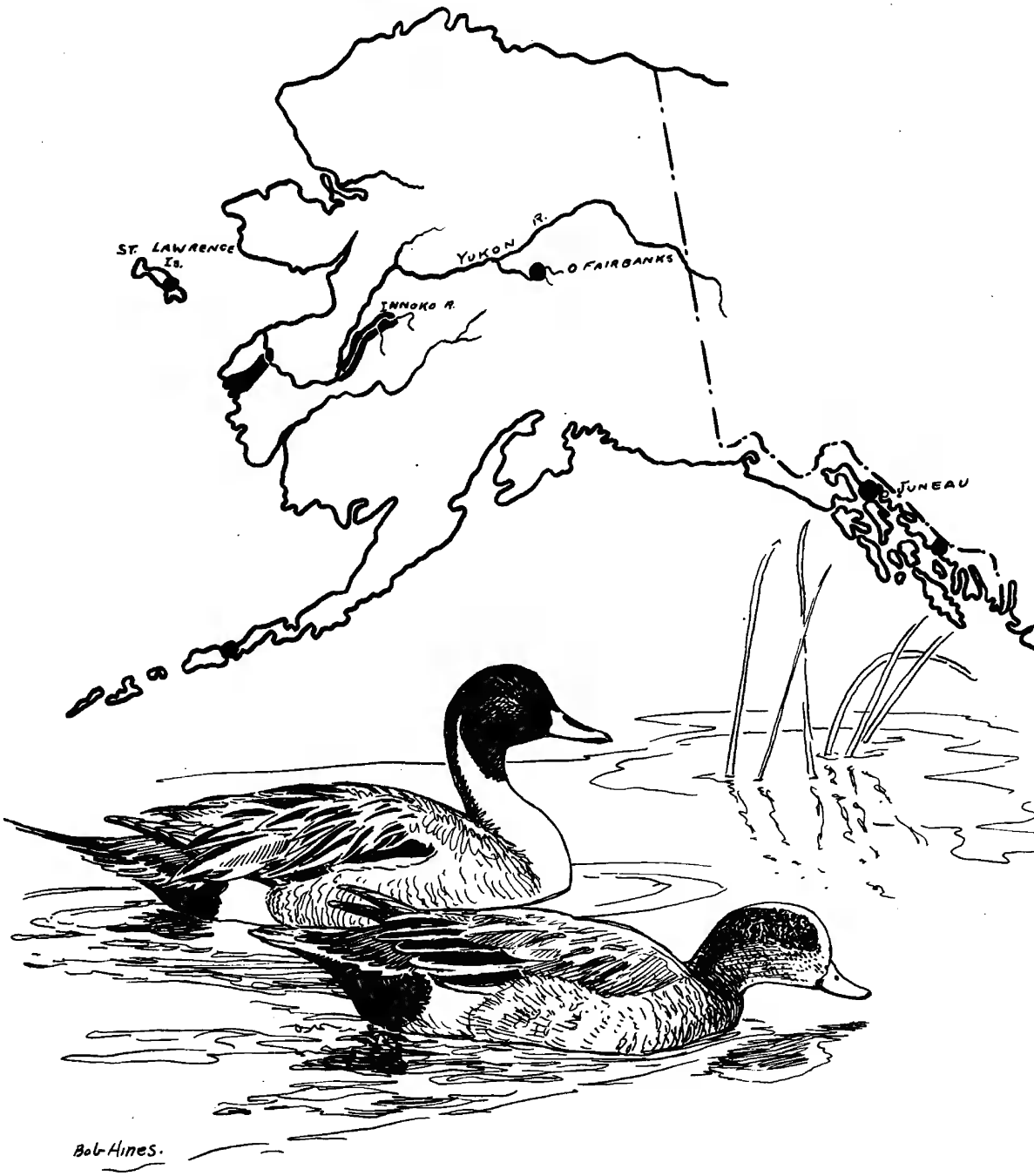
▨ AREA FLOWN FIRST TIME IN 1950



Blank Page Digitally Inserted

WATERFOWL BANDING AREAS
ALASKA - 1950

■ BANDING AREA



Blank Page Digitally Inserted

Birds Banded in Alaska - 1950

Species	Adults			Immature			
	Male	Female	Sex Not determined	Male	Female	Sex Not determined	Total
Geese							
White-fronted	53	75	6	3	10	11	158
Emperor	1	1	1	72	85	81	241
Lesser Canada	3	11	-	52	45	-	111
Cackling	7	20	10	431	417	216	1101
Black brant	192	178	401	507	541	635	2454
W. Canada	-	-	2	-	-	-	2
Swan							
Whistling	-	-	1	3	4	-	8
Ducks							
Baldpate	-	-	-	11	8	1	20
Spec. Eider	-	2	-	33	32	-	67
G-w. teal	5	1	-	8	6	-	20
Mallard	4	-	-	7	5	-	16
Shoveler	-	-	-	1	4	-	5
W-w. scoter	-	-	-	-	1	-	1
Pintail	68	28	-	188	178	8	470
Others							
Arctic tern	-	-	-	-	-	33	33
L. brown crane	-	-	-	-	-	6	6
Goshawk	-	-	-	-	-	2	2
Pacific loon	-	-	-	-	-	1	1
Red-t. loon	2	-	-	-	-	-	2
Glaucous gull	-	-	-	-	-	4	4
Pelagic cormorant	-	-	-	-	-	3	3
Least auklet	-	-	2	-	-	-	2
Crested auklet	1	-	1	-	-	-	2
Snow bunting	-	-	-	-	-	2	2
Pac. kittiwake	-	-	7	-	-	-	7
Total	336	316	431	1316	1336	1003	4738

Summary Transect Data in Alaska - 1950

Location	Sq. Mi. in Sample	Total Sq. Mi. In Area	Waterfowl per sq. mi. 1949	1950
1. Kotzebue Sound				
a. Upper Innoko - Iditarod Rivers	41.7	1171	11.7	18.8
b. Lower Yukon - Innoko Portage	103.7	2493	10.3	11.8
c. Noatak River Valley	34.6	454	13.3	17.8
d. Noatak River Delta	1.6	79	62.9	58.6
e. Kobuk River Delta	37.5	506	32.7	19.4
f. Lower Kobuk River Delta	20.5	257	46.9	27.9
g. Upper Kobuk River Delta	17.2	250	16.1	9.5
h. Selawik River Delta	47.2	1002	24.6	23.0
i. Buckland River Delta	7.8	60	206.7	186.9
j. Goodhope Bay - Cape Espenberg	5.0	-	54.7	49.2
k. Cape Espenberg Lagoon	3.2	18	99.5	105.6
2. Cape Espenberg to Shishmaref Inlet	11.7	-	-	21.7
3. Shishmaref Inlet Perimeter	9.2	-	-	68.9
4. Serpentine Flats	3.8	30	-	244.4
5. Yukon - Kuskokwim Delta	407.0	19,000	16.5	17.4
6. Arctic Coast	285.0	285	2.5	2.6
7. Minto Lakes	15.0	-	-	8.7

Comparative Totals 1949 - 1950

	Waterfowl per sq. mi. 1949	1950
Kotzebue Sound (a-k above)	36.2	30.2
Yukon - Kuskokwim Delta	16.5	17.4
Arctic Coast	2.5	2.6

Brood Counts by Number of Broods and Average Size. Recorded by Banding Crews on Innoko River and Hazen - Hooper Bay Areas by Weekly Periods.

Species	7/1 - 15 No. Broods	7/1 - 15 Av. Size	7/16 - 22 No. Broods	7/16 - 22 Av. Size	7/23 - 29 No. Broods	7/23 - 29 Av. Size	7/30 - 8/6 No. Broods	7/30 - 8/6 Av. Size
Geese								
Black brant	1	4	11	4	-	-	7	4
Emperor	-	-	5	4.2	3	5.6	10	3.6
White-fronted	-	-	2	4.5	-	-	1	4
Lesser Canada	2	4	-	-	-	-	-	-
Cackling	1	5	24	4.7	4	3.9	19	4
Ducks								
Pintail	33	5.3	1	6	-	-	-	-
Shoveler	2	8	-	-	-	-	-	-
Golden-eye	5	7.3	-	-	2	9	-	-
G-w. teal	5	6.2	2	9	-	-	-	-
Baldpate	-	-	-	-	2	9	-	-
G. scaup	4	6.2	-	-	-	-	-	-
Canvasback	1	7	-	-	-	-	-	-
Spec. Eider	1	6	27	5.1	5	-	5	5.2
Swan	3	3	-	-	-	-	-	-

WATERFOWL BREEDING GROUND SURVEY IN NORTHERN ALBERTA, YUKON AND THE NORTHWEST TERRITORIES, 1950

Robert H. Smith and C. H. Safranek

Introduction

For the third consecutive year aerial surveys were conducted in northern Alberta, the Yukon, and the District of MacKenzie, Northwest Territories, to obtain quantitative information on breeding waterfowl populations for comparative purposes. In addition, new breeding areas were sampled in northern Alberta and the districts of Keewatin and Franklin, N. W. T. for which no comparative data are available.

Actual survey work began on June 6 in the Lake Claire marshes and the Athabaska delta and was concluded July 25 on Victoria Island, N. W. T. Headquarters for operations were Fort Smith, Yellowknife, Aklavik, Coppermine, Bathurst Inlet and Cambridge Bay. From Fort Smith we worked the Lake Claire-Athabaska marshes, the Hay Lakes area and adjacent region north to Great Slave Lake and the Slave River Parklands. From Yellowknife the Pre-Cambrian rock country to the east and the marsh-muskeg habitat in the Lac La Martre region to the west was covered. From Aklavik we worked the MacKenzie delta, the Eskimo Lakes region east to the Anderson River in the Northwest Territories and the Old Crow Flats in the Yukon. The southwestern portion of Victoria Island was covered from Coppermine while the southeastern portion was covered out of Cambridge Bay, as was the mainland lying between Kent Peninsula and the Armak River. Other barren land habitat on the mainland between Contwoyto Lake and Beechy Lake was covered out of Bathurst Inlet.

Survey Methods

Survey techniques have not changed since the studies began in 1948. It is essentially a sampling of the waterfowl population present in the various habitats during the breeding season by low level aerial transects, selected at random. The waterfowl populations are expressed in ducks per square mile for each type of habitat sampled and the species composition shown in percentages. Thus an index figure is obtained for each area which is comparable from year to year.

Area Covered

Reference to the map will indicate the general area covered. Each type of habitat sampled in previous years has been described in past reports. Consequently only the areas sampled for the first time this year will be described in this report.

Hay Lakes in Northern Alberta: These are a group of shallow marshy lakes set in an oasis of open park land. The water areas are very shallow and are subject to considerable reduction in size during drought periods. The best marshes are located in the west end of the area and contain many of the prairie type marsh plants, such as soft-stemmed bulrush, cattails, phragmites, and many underwater food plants. The borders of the marsh are low, grassy flats with a few low-growing willows providing desirable nesting cover for the ground-nesting ducks. A considerable area of these grassy flats had been burned over, presumably for pasture and hay. Waterfowl populations reflected the excellent grade of habitat as this had the heaviest duck population of all areas sampled in the far north, with most of the game ducks being represented.

Fort Rae - Gros Cap

This area is actually part of the Pre-Cambrian region bordering the north arm of Great Slave Lake on the east. It is about 20 miles in width and extends from Gros Cap to Faber Lake. The land is low lying and the lakes are shallow with marshy borders providing a much better waterfowl habitat than the deep, rock-bound lakes farther inland and supports twice as many ducks.

Contwoyto Lake - Beechy Lake

Barren lands of low relief dotted with innumerable shallow, sterile lakes. Low eskers and loose rock detritus and rubble are characteristic of this region, which probably actually covers thousands of square miles. The waterfowl population is negligible.

Kent Peninsula - Armak River

This is an area of relatively low rock outcrops, interspersed with grassy tundra, and shallow lakes and ponds bordering the Queen Maude Gulf. Many of the lakes have marshy borders. East of the Perry River the rock outcrops become higher and more numerous, and the quality of the habitat appears to be of a lower grade than from the Perry River west. It is not known how far inland this type of country extends. This area supports far more geese than game ducks and is the only known breeding area of the Ross's goose.

Victoria Island, N. W. T. (southern portion)

The section of Victoria Island covered is, with one exception, a land of low relief dotted with innumerable shallow lakes and ponds. Separating the water areas are low, rolling ridges of finely broken particles of sedimentary rock, limestone, or dolomite. The vegetative cover is very sparse and many areas are almost barren. The water areas are clear and appear to be quite sterile. The one exception to this type of country is a small area on the south coast opposite Bathurst Inlet which has the same type of bold relief and rock formations as is found directly across on the mainland. At least a portion of the Island is important as a goose nesting area but the ducks present are principally eiders and old-squaws.

Weather and Water Conditions

Weather conditions in northwestern Canada were in direct contrast with conditions in central and eastern Canada. There was very little snow during the winter and the spring and summer were unusually warm. Consequently the ice went out of the rivers and lakes early and the water remained low. The sea ice, however, was heavier than normal - 83 inches being recorded at Cambridge Bay, resulting in a late break-up.

This dry, early summer probably had a beneficial effect on the production of waterfowl as there was no flooding of early nests and broods were earlier in a region where time is a limiting factor.

Breeding Population Trends

The areas for which there are comparative data are listed below.

Lake Claire Marshes (Alberta)

Ducks per square mile: 1948 - 50.7
1949 - 254.6
1950 - 69.6

(Decrease from 1949 of 72.7%)

Percent Composition 1950

Mallard	47.5	Redhead	1.7
Pintail	17.1	Blue-winged teal	1.4
Unidentified ducks	10.1	Canvasback	1.4
Scaup	8.0	Bufflehead	0.8
Baldpate	5.1	Green-winged teal	0.6
Shoveler	3.7		

(Remainder consisting of scoters, golden-eye, mergansers, ring-necked duck and ruddy duck).

Athabaska Delta (Alberta)

Ducks per square mile: 1948 - 25.5
1949 - 53.9
1950 - 61.4

(Increase over 1949 of 13.9%)

Percent Composition 1950

Mallard	42.9	Shoveler	3.1
Pintail	27.5	Scaup	2.5
Unidentified ducks	10.9	Blue-winged teal	1.3
Canvasback	5.0	Redhead	1.2
Baldpate	4.5		

(Remainder consisting of golden-eye, bufflehead, and green-winged teal).

Slave River Parklands (N. W. T.)

Ducks per square mile: 1948 - 4.3
1949 - 6.8
1950 - 5.7

(Decrease from 1949 of 16.2%)

Percent Composition 1950

Mallard	33.8	Unidentified ducks	6.3
Baldpate	19.7	Shoveler	4.9
Scaup	13.4	Bufflehead	2.1
Pintail	12.0	Ring-necked duck	1.4
Green-winged teal	6.3		

Pre-Cambrian - Hudsonian Zone (N. W. T.)

Ducks per square mile: 1949 - 11.6
1950 - 14.7

(Increase over 1949 of 20.3%)

Percent Composition 1950

Scaup	45.6	Old-squaw	4.7
Scoters	29.6	Mallard	2.2
Unidentified ducks	8.2	Golden-eye	2.2
Baldpate	7.4	Mergansers	1.4

(Remainder consisting of green-winged teal and bufflehead)

Lac La Martre - Willow Lake Area (N. W. T.)

Ducks per square mile: 1949 - 5.7
1950 - 9.3
Canada geese per square mile: 1949 - 0.26
1950 - 1.2

(Increase over 1949 of 38.6% in ducks)

Percent Composition 1950

Scaup	48.8	Green-winged teal	3.0
Mallard	20.6	Shoveler	2.6
Baldpate	7.7	Unidentified ducks	1.3
Scoter	6.0	Canvasback	1.1
Pintail	5.8	Bufflehead	0.9

(Remainder consisting of old-squaws, blue-winged teal, golden-eye, mergansers, and redhead).

Wooded Delta (MacKenzie River, N. W. T.)

Ducks per square mile: 1948 - 27.7
1949 - 31.8
1950 - 21.2
Swans per square mile: 1948 - 1.5
1949 - .04
1950 - 1.7

(Decrease from 1949 of 33.3% in ducks).

Percent Composition 1950

Scoter	32.3	Baldpate	5.6
Scaup	23.3	Unidentified ducks	2.3
Pintail	12.2	Green-winged teal	1.7
Mallard	11.1	Mergansers	1.3
Golden-eye	9.1	Old-squaw	0.8

(Remainder consisting of canvasback and bufflehead).

Treeless Delta (MacKenzie River - N. W. T.)

Ducks per square mile:	1948 -	25.2
	1949 -	38.1
	1950 -	43.4
Swans per square mile:	1948 -	1.4
	1949 -	0.9
	1950 -	0.8
Canada geese / sq. mile:	1948 -	.03
	1949 -	.03
	1950 -	0.1
White-fronted geese / sq. mi.:	1948 -	.06
	1949 -	.04
	1950 -	.02

(Increase over 1949 of 12.3% in ducks).

Percent Composition 1950

Pintail	83.1	Mallard	3.8
Baldpate	5.5	Scoter	1.7
Scaup	4.4	Shoveler	0.6

(Remainder consisting of unidentified ducks, golden-eye, green-winged teal and canvasback).

Upland Tundra (between MacKenzie and Anderson Rivers, N. W. T.)

Ducks per square mile:	1948 -	35.4
	1949 -	32.6
	1950 -	32.8
Swan per square mile:	1948 -	1.2
	1949 -	1.0
	1950 -	1.0
Canada geese / square mile:	1948 -	0.5
	1949 -	---
	1950 -	.04
White-fronted geese/sq. mi.:	1948 -	1.9
	1949 -	0.7
	1950 -	2.5

(Increase over 1949 of 0.6% in ducks).

Percent Composition 1950

Scoters	45.7	Scaup	10.6
Old-squaw	21.0	Baldpate	1.1
Pintail	19.0		

(Remainder consisting of unidentified ducks, mergansers, mallard, green-winged teal and golden-eye).

Coastal Tundra (between MacKenzie and Anderson Rivers, N. W. T.)

Ducks per square mile:	1948 - 11.5
	1949 - 12.4
	1950 - 17.0
Swan per square mile:	1948 - 1.6
	1949 - 1.7
	1950 - 1.8
Canada geese / square mile:	1948 - 0.3
	1949 - ---
	1950 - ---
White-fronted geese / sq. mi.:	1948 - 2.0
	1949 - 0.3
	1950 - 2.5

(Increase over 1949 of 27.1% in ducks).

Percent Composition 1950

Old-squaw	38.6	Scaup	3.8
Pintail	21.6	Golden-eye	1.9
King eider	20.5	Unidentified ducks	0.9
Scoters	12.7		

Transition Zone (between MacKenzie and Anderson Rivers, N. W. T.)

Ducks per square mile:	1948 - 12.4
	1949 - 8.9
	1950 - 13.2
Swan per square mile:	1948 - 0.3
	1949 - 0.4
	1950 - 0.2

(Increase over 1949 of 32.6% in ducks).

Percent Composition 1950

Scoters	36.4	Scaup	16.4
Old-squaw	22.4	Pintail	3.9
Baldpate	19.0		

(Remainder consisting of golden-eyes and unidentified ducks).

Old Crow Flats (Yukon Territory)

Ducks per square mile:	1948 - 56.2
	1949 - 38.0
	1950 - 43.0
Geese per square mile:	1948 - 2.4
	1949 - 2.2
	1950 - 1.8

(Increase over 1949 of 11.6% in ducks).

Percent Composition 1950

Scoter	43.6	Golden-eye	3.6
Scaup	17.8	Baldpate	3.3
Canvasback	12.4	Unidentified ducks	1.3
Pintail	10.1	Mallard	0.7
Old-squaw	6.6		

MacKenzie River Delta (fringe of outer Islands)

	1948	1949	1950
Snow geese	6600	2706	4540
Black brant	300	236	26
White-fronted geese	-	144	21

Cape Dalhousie

	1948	1949	1950
Black brant	550	257	35

Kugaluk and Smoky River Deltas

	1948	1949	1950
Canada geese	261	543	62
White-fronted geese	566	484	884
Black brant	327	332	761
Snow geese	20	-	2
Unidentified geese	670	-	-

Anderson River Delta

	1948	1949	1950
Black brant	1200	1694	1182
Snow geese	700	237	848
White-fronted geese	-	197	207
Canada geese	-	24	-
Swan	-	-	300

The following areas were sampled for the first time in 1950.

Hay Lakes (Alberta)

Ducks per square mile: 1950 - 124.6

Percent Composition

Mallard	30.7	Scoters	3.5
Pintail	19.3	Blue-winged teal	2.8
Redhead	9.4	Canvasback	2.7
Scaup	7.9	Golden-eye	2.2
Unidentified ducks	6.8	Green-winged teal	1.8
Baldpate	6.5	Ruddy duck	0.7
Shoveler	5.0	Bufflehead	4.0

Fort Rae - Gros Cap (East of North Arm, Great Slave Lake, N. W. T.)

Ducks per square mile: 1950 - 29.4

Percent Composition

Scaup	53.3	Green-winged teal	1.9
Mallard	14.2	Bufflehead	1.9
Scoter	11.5	Pintail	1.6
Unidentified ducks	6.8	Shoveler	1.6
Old-squaw	3.3	Golden-eye	1.4

(Remainder consisting of ring-necked ducks and mergansers).

Contwoyto Lake - Beechy Lake, N. W. T.

Ducks per square mile: 1950 - 0.12

Percent Composition

Old-squaw 100

Armak River to Kent Peninsula, N. W. T.

Ducks per square mile:	1950 - 4.6
Swan per square mile:	1950 - 0.16
Canada geese per sq. mile:	1950 - 0.24
White-fronted geese per sq. mile:	1950 - 1.12

Percent Composition

Old-squaw	45.7	Eiders	25.9
Pintail	26.7	Unidentified ducks	1.7

Victoria Island (southwest end) N. W. T.

Ducks per square mile:	1950 - 8.9
Canada geese per square mile:	1950 - 0.14
Swan per square mile:	1950 - 0.07

Percent Composition

Eiders	60	Pintail	5
Old-squaw	35		

Victoria Island (southeast end) N. W. T.

Ducks per square mile:	1950 - 5.5
Canada geese per square mile:	1950 - 0.14
White-fronted geese per square mile:	1950 - 0.8
Swan per square mile:	1950 - 0.07

Percent Composition

Eiders	58.7	Old-squaw	41.3

Success of the Season

While no brood survey was practical this year, observations of broods made during the population studies indicated an earlier hatch, which was probably in response to the abnormally warm spring and early summer. The first brood seen in the Arctic was that of a pintail on June 19 at Old Crow. On June 22 the first snow goose broods were seen at the mouth of the MacKenzie. Well developed young of Canada geese, white-fronted geese, and swans were seen near Perry River on July 22, and a Class 1 king eider brood was seen at Cambridge Bay on July 24. Eiders are apparently normally quite late in nesting as on July 10 a few pairs were still seen inland, although at that time approximately 10,000 male king, Pacific and northern eiders were gathered in an open lead in the ice at Dolphin and Union Straits.

As far as climate is concerned the season should have been beneficial to the production of waterfowl. White foxes were more abundant than usual but it is not known what effect this might have had on nesting success. Bush fires were prevalent in the Slave River Parklands during July and possibly destroyed some nests and broods.

Summary

Considering only the areas where comparative data are available, an over-all decrease of 21.2 percent in the duck population is indicated. Taken by species the following show a decrease - mallard 63.7 percent; scoters 27.8 percent; canvasback 27.4 percent; scaup 19.8 percent; baldpate 13.2 percent. Increases were shown for old-squaw 132.9 percent; golden-eye 40.0 percent and king eider 3.7 percent. There was no significant change in pintails. Most of the decrease is accounted for in the Lake Claire marshes and the wooded portion of the MacKenzie Delta; two of the most important areas in the region covered. All other areas except one, most of them of secondary importance, indicated increases but most of the increases by areas were accounted for by increases in old-squaws. This phenomenal increase in old-squaws may be the result of a change in fishery practices in the Great Lakes, the take of old-squaws in the nests being almost negligible last winter.

Increases were noted for snow geese and white-fronted geese; Canada geese decreased and black brant showed no change.

Climatically the breeding season was early and should have been successful.

A WATERFOWL RECONNAISSANCE IN THE JAMES BAY - HUDSON BAY REGION

1950

A. S. Hawkins, E. G. Wellein, and W. F. Crissey

The primary objective of this trip was to measure waterfowl numbers along the coastal marshes and adjacent muskeg or tundra in terms of ducks and geese per square mile. We were particularly interested in learning more about goose nesting within the area examined. Counts were kept also of other kinds of wildlife, such as caribou, moose, and ptarmigan. Findings of this survey are presented in this report. The route is shown on the attached map.

We are indebted to Dr. Harrison F. Lewis for providing maps; to Deputy Commissioner Gibson, Northwest Territories, for furnishing an explorer's license; to Dr. C. H. D. Clarke for maps and suggestions; to Hudson Bay Company for aid in arranging for gas, providing details on landing sites, housing and other courtesies; to Northwest Air Command of the R. C. A. F. for permission to operate in the area under its command, and for use of its facilities at Churchill; to the U. S. Army at Churchill, where we were fed and quartered; and to the individuals at various outposts who treated us so hospitably.

Methods

To arrive at population densities, all ducks seen within one-eighth of a mile on either side of the plane were tallied. All geese seen were counted, the effective strip being about one-half mile wide. Since much of the flight was along the shores of James and Hudson Bays, the flight route was alternated between a coverage of the immediate shore line and the marshes which occurred a few miles inland. The data were kept separate and have been presented separately in the two tables included with this report. The strip adjacent to the Bays has been termed "coastal", while coverage a mile or more from the shore has been termed "interior."

One observer spent full time recording ducks and geese by species, while the pilot and second observer counted total ducks and geese on their hand tally counters.

Weather Conditions

We were informed that the season was at least two weeks late along the entire route traveled. Ice break-up dates, arrival dates and other phenological indicators from Moosonee to Eskimo Point all agreed on this point. The season has been unusually wet as well as cold. Moosonee reported rain on 24 of the first 25 days of June. Attawapiskat and northward reported that mosquitoes had bothered on only one or two days due to the cold. On the north side of Akimiski Island the bay was full of floating ice, a condition which remained constant from there northward. On the same date in 1949, except for icebergs and an ice field far off-shore, the bay was clear north to 60 degrees.

During our 1949 trip, which was much less extensive than this year's, but at the same calendar time, we recorded 96 duck broods. This year until we reached the Saskatchewan Delta Marshes, we saw only one brood of ducks.

Populations

A total of 15,855 ducks, 3,504 Canada geese and about 17,000 other geese were recorded along the transects. These data are summarized in Tables 1 - 3.

Duck densities were 52.8 per square mile along the coast and 3.7 per square mile in the interior. Goose densities could not be assessed fairly by this method because of their habit of gathering in large groups. Of the more than 20,000 that were seen, over 10,000 (mostly snows) were in one group. The Canadas were more evenly distributed, but of these, nearly a third were seen on Akimiski Island.

Species

Snow Geese: This species was the most numerous observed on the trip, largely due to concentrations of several hundred on Cape Henrietta Maria and an estimated 15,000 at the mouths of the Thlewieza - Tha-Anne Rivers, and the next river to the north. A few scattered snows occurred in between these points. On the Cape three downy young were seen with two adult snows. Strangely, the downies were not yellow as snow geese young are supposed to be, but rather dark-colored, like blue geese. On this point we all agreed. (Almost exactly a year earlier, a similar observation was made on the Owl River in Manitoba.) This is the only definite evidence obtained that wavies were nesting on the Cape. While observing the large concentration at the mouth of the Thlewieza, however, we saw a hundred or more nests from the air. On the small islands formed by the river delta, nests protected by pairs of geese were spaced very close together. North of this concentration at the mouth of the next river (unnamed on our map) was another large group of wavies, but only a few nests were seen. Some of these geese appeared to be flightless, and it is possible that most of them were non-breeders.

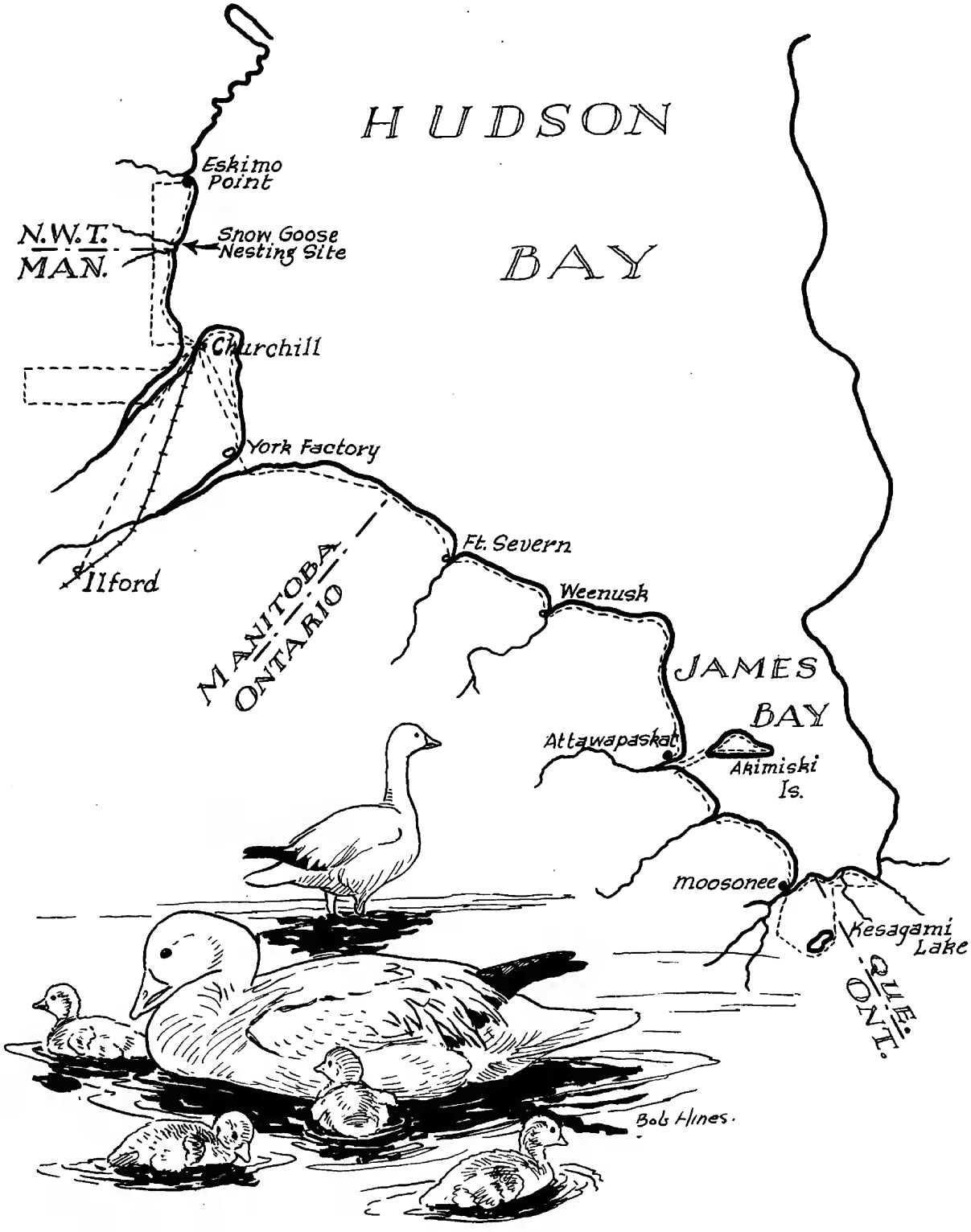
Mallard: The northernmost record obtained was at 59 degrees 40 minutes both along the coast (2 drakes) and interior (1 drake) along the 59 degree longitude line. Only a few additional mallards were noted along transects north of York Factory where about 30 drakes were seen in a flock. The majority of the other mallards tallied were along James Bay south of the tundra.

Black Duck: This species outnumbered its nearest rival, the pintail, 3 to 1 along the south coast of James Bay, but then dropped behind, except on Akimiski Island, along the remainder of the coast. Even from Churchill north to 60 degrees it composed 28 percent of the total number of ducks recorded. It was last seen a few miles short of 60 degrees and as far west as the outlet of South Knife Lake (96 degrees 20 minutes). Between the Hudson Bay railroad and the coast, it appeared to be the most common dabbler. It occurred as pairs or singles (hence presumably was breeding) on the interior tundra, but usually along brushy streams. Along the coast its breeding status could not be determined, as it occurred in flocks as well as pairs or singles. It is possible that these birds were drakes assembling in the coastal marshes for the moult, from considerable distances. The only duck brood seen on the entire trip was believed to be that of a black duck.

Pintail: By far the most numerous and widespread duck seen along the coast, the pintail occurred mostly in small groups. One flock near Attawapiskat, however, numbered about a thousand. Many drakes were in good plumage, and with them were a few hens. An occasional pair was seen. This was the only dabbler seen north of 60 degrees.

Baldpate and Green-winged Teal: These two ducks were equally common, according to our data, but since teal often escape aerial observation, the latter species probably ranks higher than our figures show. No other dabblers were seen in appreciable numbers. The only other sporting duck seen in large numbers was the scaup. On the tundra and in the transition zone, all scaups that were positively identified were greater scaup. This species away from the bay, composed 18 percent of the ducks recorded.

AERIAL TRANSECTS - HUDSON BAY AREA
1950



Blank Page Digitally Inserted

It should be noted that about half of the interior count (52 percent) were non-game ducks (at least so rated in the Mississippi Flyway), including scoters, eiders, old squaws, and mergansers. This would reduce the sporting duck density in the interior to 1.7 ducks per square mile. Along the coast the scaup was the only diver which contributed more than one percent (2.7 percent) to the total count. This was because our transects failed to include the off-shore flocks of scoters, eiders, and other divers. Among the eiders, only one king eider was seen; the rest were American eiders. All three scoters were found in numbers. Along the bay, the American scoter was most common; in the interior the white-winged scoter predominated, except along the Tadoule Lake - Knife Lake transect where surf scoters were common. We suspect that the old squaw was more abundant than our figures indicate. This species seems more plane-shy than the other ducks surveyed.

While 17 whistling swans were seen, no evidence of nesting was found. Canada geese were noted on 22 of the 27 transects. Along the coast, broods were seen along 4 of 13 transects, and in the interior on 9 of 14. However, 46 of the 79 broods tallied were found along the coastal strip. The 35 found on Akimiski Island and 6 on Cape Churchill account for most of the broods near the Bay. All of the young geese seen appeared to be less than two weeks old. A large part of the adult population did not fly when approached by the plane, presumably because they were in the flightless stage of the moult. It seems probable that these were non-breeders, probably yearlings; by far the heaviest population of Canadas found was on Akimiski Island. Elsewhere, evidence of breeding was noted in widely-scattered localities.

Summering flocks of Richardson's geese were found along the south end of James Bay and on Cape Henrietta Maria. Blue geese were first encountered on the cape where they numbered several hundred, mostly in large flocks. A few were seen at widely-spaced intervals elsewhere along the coast to the mouths of the Thlewieza and Tha-Anne Rivers, where a few hundred were mixed with many more snow geese. At this location it is certain that blues were nesting. At least three instances were observed of a blue paired with a snow.

Canada Goose Nesting Populations

Goose ranges continued without interruption, so far as we could tell, from Wawa Lake southwest of Moosonee to Eskimo Point. Along this entire strip, however, the only place where Canadas appeared to be nesting in large numbers was on Akimiski Island. Otherwise, the population appeared to be widely-scattered. At Weenusk we were given 5 goose bands, recently acquired, two of which were of the colored type used at Horseshoe Lake, Illinois. Another was a spring banding at Jack Miner's. Upon returning to Delta we received a letter from Refuge Manager Dill informing us that 7 Canadas which he had banded at Swan Lake Refuge had been shot this spring near York Factory. Weenusk and York Factory are 200 airline miles apart, hence somewhere between may mark the boundary between the population wintering in Illinois and that wintering in Missouri. North of Churchill we may have been observing Lesser Canadas, but the difference between those sub-species cannot be determined from the air. Our observations to date would indicate that Canada goose production in Manitoba may be on a par with that in Ontario. It is probable that the Mississippi Flyway population originates over a much wider breeding range than hitherto supposed.

Species Other Than Waterfowl

The first caribou of the trip was seen near York Factory. Approaching Churchill from the southeast, and within sight of the grain elevator, 4 more were seen. On Cape Churchill we counted 255, and in northern Manitoba, a few miles short of the 60th parallel, 113 more. The total number of caribou seen in Manitoba: 373.

Along our transects in Northwest Territories we counted 4, 606 caribou. This population was quite evenly distributed over 120 lineal miles of transect.

We estimated that the effective count covered a half-mile strip, which yields an average density of 76.5 animals per square mile. Since the animals were quite evenly distributed both along the Bay and inland, it appeared logical to assume that the density observed held true for the entire block surrounded by the transect. On this basis, the caribou population of the 1500 square miles involved would be 114, 750. It is worthy of note that neither to the north or to the west of our transect was there any sign of diminution in caribou numbers.

One curious observation was the fact that several calf caribou, apparently several weeks old, were seen with the small Cape Churchill herd while none were seen with the large herd in the Northwest Territories. Yearlings could be identified in both herds.

Cranes, either sandhill or little brown, were seen as follows:

Wawa Lakes	2
Manitoba (between 59 and 60 degrees latitude)	5
Northwest Territories	11

These birds occurred as isolated pairs or singles mostly in a muskeg type habitat.

Other animals and birds seen included 13 moose, 1 bear, 7 wolves, 4 foxes, 2 snowy owls, and 319 ptarmigan.

While no counts were kept of seals or white whales, it should be mentioned that on the flat ice fields still remaining in Button Bay and east of Churchill several hundred seals were observed. In Churchill Harbor, white whales were present by the hundreds.

Table 1. - Numbers of Ducks and Geese Observed Along Coastal Marshes of James and Hudson Bays

Transect	Sq. Mi.	NUMBER Ducks	Geese	Goose Broods	Ducks / Sq. Mi.
Gull Bay - Nottaway R.	15.0	490	296	-	32.7
Ship Sand Island - Gull Bay	20.6	1349	66	2	65.5
Moose River - Attawapiskat River	26.2	5430	66	-	207.2
Akimiski Island	18.7	1040	734	35	55.6
Attawapiskat River - 10 mi. N. of Lake River	29.4	1840	268	-	62.6
To - Weenusk	42.5	960	2396	-	22.6
To - Fort Severn	21.5	780	501	-	36.3
To - Manitoba Line	20.6	827	481	-	40.1
To - York Factory	13.8	443	-	-	32.1
To - Churchill	3.7	170	-	-	45.9
To - 5 mi. S. of Broad Lake	22.5	433	88	6	19.2
Churchill - 60° N. Lat.	21.3	676	108	3	31.7
To - Eskimo Point	20.6	156	15,030	-	7.6
Total	276.4	14,594	20,034	46	52.8

Table 2. - Numbers of Ducks and Geese Observed - Interior to James and Hudson Bays

Transect	Sq. Mi.	NUMBER Ducks	Geese	Goose Broods	Ducks / Sq. Mi.
Nottaway River - Harricanaw River	6.2	3	28	3	.5
To - Kesogami River	16.5	1	19	-	.1
To - Moose River	26.2	21	-	-	.8
To - Attawapiskat River	9.1	77	-	-	8.5
Akimiski Island	15.7	80	306	10	5.1
Weenusk - Fort Severn	6.0	30	6	-	5.0
Cape Tatum	16.2	112	-	-	6.9
York Factory - Churchill	31.9	88	25	7	2.7
Owl River - Churchill	23.1	65	37	3	2.8
Eskimo R. - McConnel R.	30.0	82	43	1	2.7
60° N. Lat. - Churchill	27.5	193	58	1	7.0
To - Tadoule Lake	41.2	115	70	2	2.8
To - Fox Lake - Churchill	42.5	255	16	2	6.0
To - Ilford	48.7	142	31	4	2.9
Total	340.8	1264	639	33	3.7

Table 3. - Species Composition of Ducks and Geese Observed Along Interior and Coastal Marshes of James and Hudson Bays

DUCKS

Species	INTERIOR Number	INTERIOR Percent	COASTAL MARSHES Number	COASTAL MARSHES Percent
Mallard	32	3.2	425	4.9
Black duck	88	8.9	2208	25.6
Baldpate	19	1.9	308	3.6
Pintail	142	14.3	4928	57.1
G-w. teal	10	1.0	323	3.7
Shoveler	-	-	4	tr.
Scaup	178	18.0	236	2.7
Ringneck	-	-	3	tr.
Eider	12	1.2	69	.8
Scoter	400	40.4	66	.8
Old squaw	67	6.8	63	.7
Merganser	39	3.9	10	tr.
Golden-eye	4	.4	-	-
Total	991	100.0	8643	99.9

GEESE

Species	INTERIOR Number	INTERIOR Percent	COASTAL MARSHES Number	COASTAL MARSHES Percent
Canada geese	639	100.0	2865	14.3
Richardson's geese	-	-	510	2.5
Snow and blue geese	-	-	16,659	83.2
Total	639	100.0	20,034	100.0

WATERFOWL BREEDING CONDITIONS IN BRITISH COLUMBIA - SUMMER 1950

David A. Munro and R. H. Mackay

Introduction

During the summer of 1950 a party sponsored by the British Columbia Game Commission and the Department of Zoology of the University of British Columbia explored waterfowl habitat in the Stum Lake area, and for the third successive year continued banding activities in the Chilcotin and Cariboo regions. Robert H. Smith and C. H. Safranek, of the U. S. Fish and Wildlife Service, made aerial surveys of waterfowl habitat in the southern and central interior and on the southern coast of the Province. R. H. Mackay and D. A. Munro, of the Canadian Wildlife Service, made observations of waterfowl on previously established key areas in the Cariboo Parklands and Upper Columbia Valley, and in the Kamloops, Okanagan and Nicola regions, where key areas for taking comparative censuses are being selected.

Weather and Water Conditions

In 1949-50 British Columbia again experienced a long and severe winter with heavy snowfall in many areas. A cold and retarded spring was also recorded and as a consequence the annual run-off was considerably later than usual. In the interior of the Province on May 31 snow still lay at elevations above 3,000 feet, and lakes above 4,000 feet were still frozen. The Fraser and Columbia Rivers were not in full flood until the latter part of June.

Precipitation since early May had been considerably below normal. However, because of the heavy and protracted run-off, water levels had not appreciably declined. The dry weather probably benefited the survival of broods.

Aerial Surveys

R. H. Smith and D. A. Munro made, for the first time, aerial surveys of the Okanagan, Kamloops and Nicola areas and the Upper Columbia Valley. Because of the irregular nature of the terrain and the scattered disposition of waterfowl habitat, the former three areas are not considered to be suitable for taking regular aerial censuses. The reconnaissance of these areas was, however, of considerable interest and benefit. The Upper Columbia Valley lends itself well to aerial census. Figures approximating a total count, obtained on May 19, are given below:

Upper Columbia Valley:

Square miles sampled: Approximately 80
Ducks per square mile: 19.9
Canada geese per square mile: 20.1

Canada goose	1612	Wood duck	1
Swan	2	Redhead	8
Mallard	773	Canvasback	27
Pintail	2	Scaup	18
Green-winged teal	24	Golden-eye	79
Blue-winged teal	83	Bufflehead	2
Baldpate	167	Others	37
Shoveler	1	Unidentified	376

The counts of golden-eye and bufflehead do not reflect the actual abundance of these species.

R. H. Smith and C. H. Safranek obtained comparative data for the Chilcotin region and the area north and west of Prince George. The data obtained for these areas are as follows:

Chilcotin:

Square miles sampled: 29.5
Ducks per square mile: 14.6

Scaup	32.1%	Golden-eye	4.6%
Scoters	24.3%	Pintail	2.3%
Mallard	16.6%	Baldpate	1.3%
Unidentified	16.2%		

The remainder consisted of green-winged teal, shoveler, ring-necked duck and redhead. In this sample 5 Canada geese were seen. This represents a 30 percent decrease from the 1949 sample.

North and West of Prince George:

Square miles sampled: 28.3
Ducks per square mile: 2.1

Golden-eye	45 %	Mallard	18.3 %
Scaup	20 %	Ring-necked duck	5 %

The remainder consisted of pintail, bufflehead, merganser and scoter. In this sample 4 Canada geese were seen.

This represents a decrease of 43 percent from the 1949 sample. It is thought that the retarded spring may have been responsible in part for these decreases.

R. H. Smith and C. H. Safranek also made, for the first time, an aerial survey of the Cariboo area south and east of Williams Lake, and a reconnaissance of the east coast and the northern portion of the west coast of Vancouver Island. Data obtained in the survey of the Cariboo area are as follows:

Cariboo Area:

Square miles sampled: 25.5
Ducks per square mile: 11.5

Scaup	35.1 %	Unidentified ducks	4.4 %
Golden-eye	26.7 %	Canvasback	3 %
Mallard	18.2 %	Green-winged teal	2.8 %
Bufflehead	8.4 %		

The remainder consisted of pintail and baldpate. On this transect 14 Canada geese were recorded.

Ground Survey - Cariboo Area

Observations in the Cariboo area were made by R. H. Mackay during May and July. Comparable observations were made in previous years by J. A. Munro. A summary of spring waterfowl counts made on twelve key areas is given below.

Table of Comparative Numbers - Cariboo Parklands - Spring

Species	1946	1947	1949	1950
Mallard	39	25	10	35
Pintail	12	15	1	19
Green-winged teal	7	19	2	5
Shoveler	5	9	2	5
Baldpate	73	56	13	28
Ring-necked duck	3	7	0	1
Redhead	12	28	32	32
Canvasback	21	17	25	20
Lesser scaup	403	467	155	476
Barrow's golden-eye	57	116	66	136
Bufflehead	79	100	30	117
Ruddy duck	31	42	28	59
Total Ducks	742	901	364	933
Coot	447	167	35	170

Mid-summer counts on the same areas follow.

Table of Comparative Numbers - Summer

	1948		1949		1950	
Species	Adult	Young	Adult	Young	Adult	Young
Mallard	50	29	33	31	41	24
Pintail	1	--	8	18	29	27
G-w. teal	7	--	15	15	24	30
B-w. teal	31	--	23	--	62	13
Baldpate	192	13	48	188	52	82
Shoveler	11	--	10	--	7	17
Redhead	28	14	12	31	14	24
Ring-necked duck	--	--	--	--	14	--
Canvasback	26	68	10	75	9	25
Lesser scaup	344	--	358	18	222	21
Barrow's golden-eye	88	148	61	280	142	169
Bufflehead	48	72	46	120	46	46
Ruddy duck	96	8	9	25	33	6
American coot	61	24	93	105	71	87
Total	922	352	633	801	695	484

The increase in the waterfowl population noted in the spring survey is less noticeable in the midsummer count, and corroborates the supposition that part of the spring count was made up of migrant birds. Adult birds counted this summer from July 8 to July 20 show a slight increase over those counted last year. Young birds, particularly baldpate, canvasback, Barrow's golden-eye and bufflehead, show a marked decline in numbers. The apparent decreases in young baldpate and canvasback are possibly due to the delayed advent of the breeding season. Several broods of baldpate were found to be too small for banding purposes by members of the British Columbia Game Department staff. The reduction in young golden-eye and bufflehead perhaps reflects a reduction in breeding stock. Figures for adults of these species include non-breeding yearlings.

Banding operations conducted by a British Columbia Game Department party in a comparable period on the same areas have not been significantly less successful in 1950 than in 1949. An expedition to Stum Lake in the Chilcotin region resulted in the banding of 111 young pelicans.

Ground Survey - Upper Columbia Valley

Censuses of ten sample areas were made in May by D. A. Munro for the third consecutive year. Comparative counts are given in the following table.

Table of Comparative Numbers - Upper Columbia Valley - Ten Sample Areas - Brisco to Golden

Species	May 1948	May 1949	May 1950
Mallard	172	87	94
Pintail	1	3	2
Baldpate	13	9	6
Green-winged teal	--	4	1
Blue-winged teal	4	21	5
Cinnamon teal	2	2	2
Shoveler	--	--	2
Wood duck	--	--	4
Redhead	--	--	2
Ring-necked duck	13	2	3
Lesser scaup	--	--	3
Golden-eye	73	19	47
Bufflehead	19	14	18
Hooded merganser	--	--	3
Total ducks	297	161	192
Canada geese (Nests)	23	17	20
Coot	84	45	30

These figures show a slight increase over last year - approximately 15 percent for both ducks and geese. Coots show a decline of 33 percent. Mallard, golden-eye, and bufflehead, the most abundant species in the Valley, all show slight increases this year. Baldpate, green-winged teal, and blue-winged teal show a decline.

The first broods of ducks seen were: mallard, May 27; Barrow's golden-eye, May 29. A late brood noted was of Barrow's golden-eye, four weeks old, on August 19.

A total of 89 nests of Canada geese were found in the Upper Columbia Valley and at Vaseaux Lake in the southern Okanagan Valley. The average clutch was 5.3. The average hatch from 82 of these nests was 4.4. The average clutch size was greater in 1949, but the average hatch was slightly less. The first broods of Canada geese were seen as follows: Vaseaux Lake, May 6; Columbia Valley, May 8. In spite of the delayed spring the peak of hatching was one week earlier this year than in 1948 or 1949.

Observations during the latter part of the summer were not made to the same extent as in 1948 and 1949.

Ground Survey – Okanagan, Kamloops and Nicola Areas

Extensive observations of waterfowl and waterfowl habitat have been made by D. A. Munro in the Okanagan Valley and on range-land areas in the vicinity of Kamloops, Merritt and Aspen Grove. One of the main objects of this work has been to furnish a basis for selecting a series of key lakes to be used for regular censuses in the future. General data on waterfowl life histories have been gathered.

Early broods seen in these areas were as follows: mallard, (3 weeks old), June 6; pintail, June 8; Barrow's golden-eye, June 8. Late broods noted were of blue-winged teal (4 weeks old) on September 5, and of ruddy duck (3 weeks old) on September 7.

Brood Survival

Brood counts made by D. A. Munro and R. H. Mackay in all parts of the southern interior of the Province are summarized below. The bracketed figure refers to number of broods counted. The data referring to blue-winged teal may include some cinnamon teal.

Brood Averages

Species	0-1 week	1-4 weeks	All broods
Canada geese	4.3 (13)	5.4 (15)	4.9 (28)

Species	0-1 week	1-8 weeks	8 weeks-full grown	All broods
Mallard	8.4 (5)	7.6 (35)	6.7 (10)	7.5 (50)
Gadwall	---	5.0 (1)	---	5.0 (1)
Pintail	8.0 (2)	6.2 (20)	---	6.3 (22)
Green-winged teal	---	8.7 (7)	8.0 (1)	8.6 (8)
Blue-winged teal	7.1 (3)	8.0 (15)	8.0 (2)	7.9 (20)
Baldpate	8.0 (2)	7.4 (28)	7.0 (1)	7.6 (31)
Shoveler	8.5 (2)	5.2 (5)	---	6.1 (7)
Redhead	7.0 (4)	5.3 (13)	---	5.7 (17)
Canvasback	---	8.7 (4)	---	8.7 (4)
Lesser scaup	11.3 (13)	6.5 (17)	6.4 (5)	8.3 (35)
Barrow's golden-eye	7.2 (10)	6.4 (67)	5.3 (10)	6.5 (87)
Bufflehead	---	6.5 (24)	7.0 (3)	6.6 (27)
Ruddy duck	7.3 (9)	5.0 (21)	---	5.7 (30)
American coot	4.3 (7)	5.1 (40)	---	5.0 (47)

Brood averages as given above appear to be highly satisfactory, particularly those of mallard, baldpate, green-winged teal, and blue-winged teal. The high average for newly-hatched broods of lesser scaup duck reflects the inclusion in the average of 2 broods of 15, and of a group of 64 young accompanying 4 females.

Summary

Weather and water conditions have been particularly favourable for waterfowl production in British Columbia in 1950. While the results of certain spring censuses appeared to be contradictory, it seems likely that, since those indicating a decrease were taken further north or at greater elevation than those indicating an increase, the spring migration was slower than usual and thus complicated the analysis of population figures. Population data obtained in the summer suggest little change in most species in relation to 1949. The increase in blue-winged teal reported in 1949 has probably

been maintained, but a similarly reported increase in baldpate cannot be verified this year. There may have been a reduction in breeding stock of bufflehead and Barrow's golden-eye. The reduced midsummer count of canvasback in the Cariboo may be cause for alarm. Brood survival of all species appears to have been satisfactory.

WATERFOWL BREEDING GROUND SURVEY IN ALBERTA - 1950

Allen G. Smith

The 1950 Alberta waterfowl survey was conducted as a cooperative venture between the Dominion Wildlife Division, the Alberta Game Branch and the United States Fish and Wildlife Service. Its primary objectives were to evaluate the waterfowl breeding ground conditions of southern and central Alberta, to appraise the breeding population found there, and to attempt to evaluate the production of this population in the light of the various environmental factors which affect these populations.

This is the fourth consecutive year that a ground survey of this type has been conducted in Alberta and the second year that an aerial survey has been made. However, due to the fact that the first aerial work was done in 1948, the 1950 aerial data are not sufficiently comparable to those of two years ago to be wholly applicable.

The 1950 survey was divided into three major types of activity; the aerial population and production studies, the ground population and production studies, and the banding activities. Aerial population trend appraisals were made from May 11 to May 27 by G. H. Jensen, U. S. Fish and Wildlife Service (pilot) and Joseph Gau, Alberta Game Branch (observer). Aerial production flights were made by the same men from July 11 until July 25. Ground population trend appraisals were made by G. Alan West, Dominion Wildlife Division, Roy C. Anderson and Joseph Gau, Alberta Game Branch, and the writer. Production studies by the ground crew were made from July 1 until July 28, with the exception of the period from July 8 to July 16, when the ground and air crews combined operations for banding. Aerial transects were flown twice and ground transects were run three times during the course of the summer.

In addition to the personnel mentioned above, we were fortunate again to secure the services of many of the Forest Rangers of the Northern Alberta Forest Districts. These men furnished a considerable amount of climatological and migration data which was very helpful in appraising the early aspects of the 1950 waterfowl migrations in northern Alberta.

Survey Methods

Ground and aerial transects were run throughout the southern and central portions of Alberta in all soil and vegetative types. This study area represents approximately 65,000 square miles. Ground transects were run in the same manner as in 1947, 1948, and 1949, as described in the reports of those years. Aerial transects were run in the same manner as in 1948 (waterfowl counts on strips 1/8th mile in width each side of the plane, which was flown at an altitude of from 150 to 200 feet). However, many of those transects flown in 1948 were abandoned or relocated this year and new ones were added, which adjustments made for a better aerial coverage than was possible in 1948. In that year, many flights were of a more or less exploratory nature.

Fifty flight hours were utilized to make the aerial population trend survey, comprising a sample of 739 square miles. Five hundred and seventy-five square miles of ground transects were completed, making a grand total of 1,314 square miles, or an approximate 2 percent sample of the waterfowl habitats of southern and central Alberta.

Drought severely hampered our ability to secure complete nest histories. Early disappearance of water, which was present in the south when the mallards and pintails began to nest, created a large area in that region from which nest data is

almost completely lacking. Much of the parkland pothole habitat reflected like conditions. As a result, selected areas were used to gather most of the nest data, but due both to the lateness of the nesting season and the erratic nature of the nesting, it was not possible to make many completed nest histories on these locations.

Weather and Water Conditions

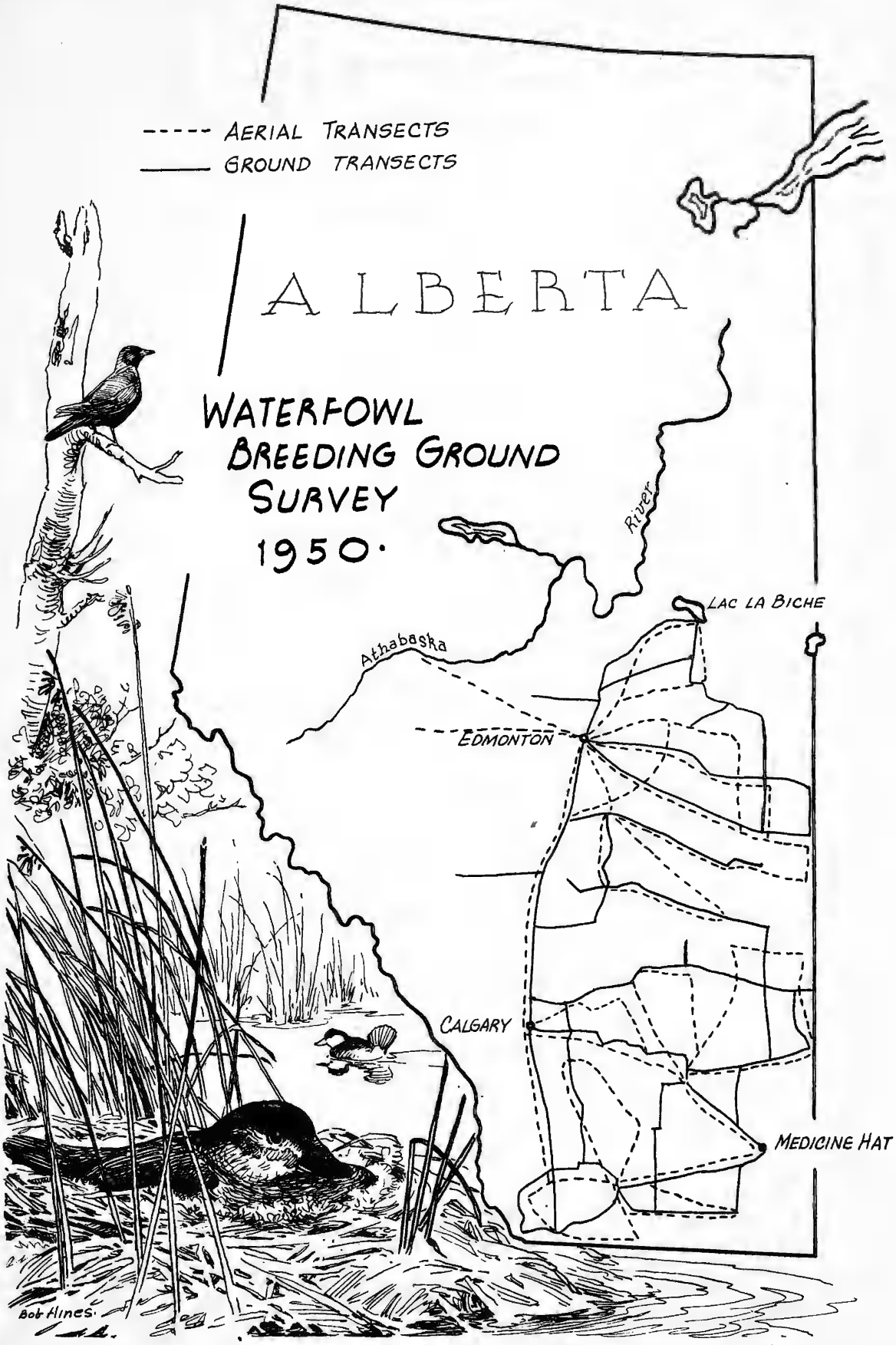
Despite the fact that there was a good snowfall during the past winter, run-off was very slow in the spring and most of the water was absorbed into the soil. Sub-soil moisture reserves were very low this spring and rainfall was light in April and non-existent in May and most of June. Surface water and sub-soil reserves continued to deteriorate rapidly during this period. Nevertheless, the moisture accumulation during the winter of 1949-1950 was sufficient to show a marked improvement of surface water conditions on the prairies in May. The rapidity of its disappearance and its position in relation to the condition of the breeding grounds in the past three years may be noted in Table 1.

Table 1. -- Water Areas on Ground Transects from 1948 to 1950

Type	May 1948	May 1949	June 1949	May 1950	June 1950
Prairies	1904	234	244	808	334
Transition	535	127	82	298	116
Parklands	1886	426	298	675	281
TOTALS	4325	787	624	1781	731

The situation in May of 1948 may be considered good, as far as water conditions are concerned. Using this as a base figure, we find that 1949's drought resulted in a loss of 81 percent of the water present in May of 1948. In May of 1950 we find a 126 percent improvement over 1949, but this figure is very deceptive, as it is still a loss of 58 percent over 1948 conditions. By June of 1949 Alberta had lost 21 percent of the ground water present on the transects in May, but in June of 1950 there had been a decrease of 58 percent of the water present the month before. This helps to classify the temporary nature of the apparently improved water conditions in May. Most important of all in analyzing the water conditions on the breeding grounds in 1949 and 1950 is to stress the great difference which prevailed in the two drought years when the birds arrived in the spring. Last year the water was not present on the prairies when the ducks came. As a result, they moved on to more suitable areas. This year, the water was present in sufficient quantities for the ducks to begin nesting. Not only was this true, but one of the most important of the early breeders, the pintail, showed a 32 percent increase in population over the 1949 figures. With the rapid disappearance of water in the south as the nesting season advanced, these early nesters (pintails and mallards) were forced to desert their nests and seek water elsewhere. Thus, we find that the drought of 1949 was of such intensity in early spring as to assure a better production of waterfowl than might normally be expected because the ducks moved on to better areas. This year, the drought areas acted as a trap, causing the birds to nest. This in turn was followed by mass desertions in many southern areas.

After a cool, windy May, characterized by many dust storms and severe soil drifting, the first light rains began to fall in late June. This precipitation was of no value to the ducks, though it was of value to the wheat. Not until July and August did sufficient rain come to insure against any great changes in existing water levels until such time as the ducklings would be on the wing. Despite pronouncements to the contrary, these rains did not change the picture as far as 1950 waterfowl production was concerned, except so far as already stated, - it safeguarded the water levels of remaining water areas and prevented further losses of existing broods or of


----- AERIAL TRANSECTS
——— GROUND TRANSECTS
ALBERTA
WATERFOWL
BREEDING GROUND
SURVEY
1950.
River
LAC LA BICHE
Athabaska
EDMONTON
CALGARY
MEDICINE HAT
Bob Hines.

Blank Page Digitally Inserted

broods about to hatch in areas where water was then present. No amounts of rain falling as late as they did this year could offset the fact that there had been a serious curtailment of the nesting activities of pintails and mallards due to the loss of first nests in southern and central portions of the Province. Evidence of this loss will be presented elsewhere in this report.

To emphasize further the extent and seriousness of the drought this year, 179 square miles, or 31 percent of our ground transects were devoid of water or ducks by July 1. In May all of these transects had both water and breeding ducks. Of all aerial transects, 43 square miles were devoid of ducks by July, 41 square miles more contained only 3 broods and an additional 49 square miles had only 6 broods at the second running.

Waterfowl Breeding Population Trends

With the exception of the late arrival of the blue-winged teal, waterfowl migrations in southern and central Alberta were generally about normal in 1950, chronologically speaking. As a result of the first running of our ground transects in May, we found an average population of 11.9 ducks per square mile on our comparable transects. In 1949, we found 13.9 ducks per square mile on the same areas, or an indicated loss of 14.4 percent. Aerial coverage of the Province indicated an over-all population of 11.3 ducks per square mile. No comparable data of this type is available for 1949.

When the first coverage of Alberta was made this year it was obvious that the blue-winged teal had not yet arrived, and that this fact would have some bearing on the over-all picture of breeding populations. Therefore, when the second running was made in June, particular attention was paid to the newly arrived teal. The arrival of this species resulted in the cutting of the original loss of 14.4 percent to 7 percent.

As in 1948 and 1949, population trends on our transects were ascertained by using two different habitat classifications, soil and vegetative types. See Tables 2 and 3 below.

Table 2. -- Waterfowl Breeding Populations by Soil Types - Ground and Air *

Soil Type	Ground				Air	
	1947	1948	1949	1950	1948	1950
Brown	21.3	34.7	12.5	17.7	31.0	15.4
Dark Brown	36.6	28.6	22.5	8.2	39.5	11.9
Shallow Black	16.6	25.8	24.8	17.7	28.1	10.2
Black	20.0	11.9	25.2	11.8	15.1	8.2
Mixed	-	-	-	-	-	10.2
Gray Wooded	-	-	-	-	-	9.5

* Ducks per square mile.

Table 3. -- Waterfowl Breeding Populations by Vegetative Types - Ground and Air *

Vegetative Types	Ground			Air	
	1948	1949	1950	1948	1950
Prairie	26.2	11.7	14.2	32.0	13.9
Transition	39.9	28.0	12.6	24.5	-
Parklands	17.7	28.2	13.7	14.3	8.8

* Ducks per square mile.

Nesting Season

At the beginning of this year's survey every evidence pointed to an improved nesting season, except for the late arrival of the blue-winged teal. However, the rapid disappearance of water caused a continuing desertion of more and more areas by waterfowl and the resultant necessity for renesting. Lone females began to appear frequently by early June and by mid-June flocks of females were quite common in southern areas where water existed. The disruption of early nesting attempts was most noticeable in the sexual composition of waterfowl counted on transects throughout May and June. In early May, paired mallards and pintails were very common. Lone males increased in numbers and frequency of occurrence until about June 1. By this time, most of the temporary and intermediate water had disappeared and the water levels of permanent areas had receded seriously. Ducks left the waterless prairie transects and in some areas where water remained paired birds were in evidence again, indicating renesting attempts. But strangely enough, the build-up of the flocks of females continued, particularly in the Eastern Irrigation District, centering around Brooks. At first, it appeared that early nest desertions were being followed by a general renesting, but it soon became equally apparent that this was not occurring in sufficient degree to offset early failures. The rapid disappearance of male birds from the breeding locations by mid-June, coinciding with the appearance of many flocks of adult females, leads us to believe that too many of the adult males went into their moult at the same time that drought caused females to desert their nests. As a result, instead of renesting, a great number of females never did renest for lack of available males. This fact was further borne out by our banding records. In mid-July, 30 percent of the pintails banded were adult females. Under normal conditions, female pintails would not moult with the males in large moulting concentrations, but would congregate at a later date in smaller groups after their broods had been weaned. Thus, actual observations of the sexual composition of the waterfowl populations on our transects throughout May and June, plus the sexual composition of the adult moulting birds in July, gives us sufficient evidence that the pintail, which comprises the most numerous of breeding Alberta game ducks, suffered a serious set-back during the current season in this Province. For the first time since these surveys began, the number of pintail broods observed has dropped to second place. Considering the broods of mallards and pintails together as 100 percent see Table 4.

Table 4. .-- Mallard-Pintail Brood Relationships - 1948-1950

Species	1948	1949	1950
Mallard	24%	43%	69%
Pintail	76%	57%	31%
TOTALS	100%	100%	100%

In order to give a true picture of the broods of these two species in relation to all broods of all species observed, we found that in 1948, mallards and pintails made up 67 percent of all broods seen, in 1949 - 71 percent, and in 1950 - 61 percent.

Though a late hatch was indicated by the continued appearance of broods of downy young pintails in late July, this undoubtedly represents the broods of those birds that successfully renested. The influence of this late hatch, though important, cannot compensate for the large numbers of females who did not renest.

The earliest broods seen this year appeared on June 3. At the time of the observation the broods were about one week of age, making the hatching date approximately May 27. Broods of the following species were first observed on the dates indicated below.

Mallard	June 3	Baldpate	June 16
Pintail	June 3	Coot	June 20
Shoveler	June 10	B-w. teal	June 22
Canvasback	June 12	Gadwall	June 27
Bufflehead	June 13	Scaup	July 8
American golden-eye	" 13	Redhead	July 8

Success of the Nesting Season

Previous to 1950, it has been necessary to conclude transect observations about June 30, at which time banding work was started. This year, an extension of time was granted for the purpose of gathering more production data before the hunting regulations, thus giving us one more month of observations. Indicative of the poor hatch in June and July is the fact that in spite of the extra month of observations, we were still unable to locate as many broods on transects as was possible in only two months in 1949. In Tables 5, 6, 7, 8, and 9 below, waterfowl production data was secured on 449 square miles of ground and 585 square miles of aerial transects. This accounts for average ducks per square mile on both aerial and ground transects being slightly higher than the over-all average for the Province.

Table 5. -- Waterfowl Production by Soil Types - Ground Transects Only

Soil Type	Sq. Mi.	Ducks/sq. mi.	No. broods	Br./sq. mi.	Ducklings	Ducks/sq. mi.
Brown	106.3	15.5	33	0.31	188	1.76
Dk. Brown	122.0	9.5	50	0.41	304	2.49
Sh. Black	106.1	14.0	80	0.75	468	4.41
Black	114.8	9.9	69	0.60	426	3.71
TOTALS	449.2	Av. 12.2	232	Av. 0.51	1386	Av. 3.08

Table 6. -- Waterfowl Production by Vegetative Types - Ground Transects Only

Vegetative Type	Sq. Mi.	Ducks/sq. mi.	No. broods	Br./sq. mi.	Ducklings	Ducks/sq. mi.
Short grass prairie	236.9	12.2	57	0.24	329	1.39
Transition	46.1	9.8	17	0.36	92	1.99
Parklands	166.2	12.7	158	0.95	965	5.80
TOTALS	449.2	Av. 12.2	232	Av. 0.51	1386	Av. 3.08

Table 7. -- Waterfowl Production by Soil Types - Aerial Transects Only

Soil Type	Sq. Mi.	Ducks/sq. mi.	No. broods	Br./sq. mi.	Ducklings	Ducks/sq. mi.
Brown	154.50	15.4	61	0.39	341	2.20
Dk. Brown	126.25	11.9	147	1.17	814	6.45
Sh. Black	60.00	10.20	103	1.88	618	10.30
Black	120.50	10.3	185	1.53	1127	9.35
Mixed	123.75	12.4	175	1.43	1096	8.93
TOTALS	585.00	Av. 12.45	671	Av. 1.15	3996	Av. 6.83

Table 8. -- Waterfowl Production by Vegetative Types - Aerial Transects Only

Vegetative Type	Sq. Mi.	Ducks/sq. mi.	No. broods	Br./sq. mi.	Ducklings	Ducks/sq. mi.
Short grass prairie	317.75	13.9	212	0.67	1241	3.91
Parklands	267.25	10.6	459	1.72	2755	10.31
TOTALS	585.00	Av. 12.45	671	Av. 1.15	3996	Av. 6.83

Table 9. -- Aerial Waterfowl Production Figures For All Transects Plus Lake and Stream Surveys

Total number of broods	923
Total number of ducklings	5422
Average brood size	5.87

The basic data above presents all too clearly the seriousness of the waterfowl production picture in Alberta in 1950. By both aerial and ground survey methods we found that only a fraction of one duckling was produced per female in the observed population. With a 7 percent reduction in the original breeding population this year, a rapid disappearance of water on the breeding grounds (which occurred after the birds had established nests), plus the indicated poverty of broods produced by those birds that succeeded in renesting, it appears that except for selected areas of limited extent waterfowl production in Alberta has been poor this year. By means of an aerial survey of many of the lakes and streams of southern and central Alberta, several lakes were found to have sizeable concentrations of broods. However, there is little indication that this is other than a normal situation or that populations unsuccessful on the prairies and parklands concentrated on lakes with any success.

Summary

The 1950 waterfowl breeding season in southern and central Alberta received another set-back, possibly even worse than that of 1949. The presence of water early in the season, followed by drought conditions, caused a wave of nest desertions among both mallards and pintails. Due to the period when this happened it is probable that most of the males had already left the incubating females and had begun to congregate for moulting. Regardless of the cause, adult females of both mallards and pintails were much in evidence as flocked birds from mid-June through July, appearing as 30 percent of the total adult pintails banded in the month of July.

Clutch sizes for 1950 dropped from the 1949 level of 8.9 eggs per clutch to 7.9. Brood averages were reduced from 6.4 to 5.9 ducklings per brood. Brood densities were reduced about 50 percent, from 1.03 broods per square mile in 1949 to .51 broods in 1950. In 1949 there were an indicated .47 ducklings per adult observed in the breeding population, while this year this figure had been reduced to .24 ducklings per adult. Even with the addition of the month of July in which to make brood observations this year, a marked decrease in total numbers of broods was observed. Only 65 percent as many broods were counted on transects this year in a three month period (May through July) as were counted on the same areas in two months (May and June) of 1949.

Table 10. — Average Clutch and Brood Size Data

Species	No. of Records	No. of Eggs	Average Clutch	Class I No.	Class I Total	Class I Average	Class II No.	Class II Total	Class II Average	Class III No.	Class III Total	Class III Average	Total No.	Total Total	Total Average
Mallard	17	151	8.9	87	527	6.1	54	297	5.5	34	185	5.4	175	1009	5.8
Pintail	8	59	7.4	28	172	6.1	38	216	5.7	13	62	4.8	79	450	5.7
Gadwall	9	66	7.3	11	72	6.5	3	22	7.3	2	10	5.0	16	104	6.5
Baldpate	-	-	-	8	51	6.3	21	146	6.9	3	14	4.6	32	211	6.6
Shoveler	2	11	5.5	7	38	5.4	3	19	6.3	4	14	3.5	14	71	5.1
B-w. teal	4	43	10.7	13	85	6.5	17	106	6.2	2	8	4.0	32	199	6.2
G-w. teal	-	-	-	1	4	4.0	2	11	5.5	1	8	8.0	4	23	5.7
Canvasback	1	8	8.0	12	78	6.5	6	25	4.2	4	29	7.2	22	132	6.0
Redhead	-	-	-	10	90	9.0	6	31	5.2	1	10	10.0	17	131	7.7
Scaup	28	253	9.0	11	71	6.4	3	16	5.3	-	-	-	14	87	6.2
Bufflehead	-	-	-	2	13	6.5	1	8	8.0	1	9	9.0	4	30	7.5
Am. golden-eye	-	-	-	2	23	11.5	-	-	-	-	-	-	2	23	11.5
W-w. scoter	-	-	-	1	6	6.0	-	-	-	-	-	-	1	6	6.0
Ruddy	-	-	-	3	25	8.3	1	4	4.0	-	-	-	4	29	7.2
TOTAL	69	591		196	1255	6.4	155	901	5.8	65	349	5.4	416	2505	6.0
Coot	16	87	5.4	22	72	3.3	27	104	3.8	7	16	2.3	56	192	3.4

Table 11. — Banding Summary

Age and Sex	Canada Goose	Mallard	Pintail	Widgeon	B-w. Teal	G-w. Teal	Total
Adult Male	62	133	655	4	82	342	1278
Adult Female	64	5	292	0	0	18	379
Juvenile Male	44	9	1	0	0	2	56
Juvenile Female	55	4	2	0	0	0	61
TOTAL	225	151	950	4	82	362	1774

WATERFOWL BREEDING GROUND SURVEY IN SASKATCHEWAN, 1950

D. G. Colls

The following report deals with the results of the breeding ground and brood survey of that portion of the Province of Saskatchewan south of latitude 54°N, which area includes the Grasslands, the Aspen Parklands, and portions of the Mixed Coniferous Forest. This area is the same as that which was covered and reported in 1948 and 1949.

Population trends were determined by means of aerial and ground transects, Stephen Creech, United States Game Management Agent, and John Lynch, Biologist, flew 60 hours of air transects during May using a Stinson L-5 of the United States Fish and Wildlife Service. Marvin MacDonald, Saskatchewan Game Branch Field Officer, and D. G. Colls, Dominion Wildlife Officer, ran the ground transects, covering some 3,500 lineal miles during the month of May.

During July, V. C. Conover, United States Game Management Agent, and John Lynch, Biologist, flew another complete coverage of the aerial transects and made a brood count. W. Hyska, Saskatchewan Game Branch Field Officer, and A. Benson, Biologist, ran a brood count over the ground transects.

Methods

Aerial and ground work followed the basic pattern set up in 1948.

The 17 unwieldy air survey regions which have been used since 1948 were discarded this year in favour of the more simplified four soil regions used by the ground crews. This enabled the aerial crew to employ fewer transects of greater individual length, and will permit of more ready comparison of air and ground data.

The wet spring made several country roads in the western part of the Province impassable during the May ground coverage. Out of the total of 49 transects, 39 were completely run and 1 was only partially run.

The only change in the basic pattern of the transect work was that the data obtained along aerial and ground transects were kept by segments. In the air, information was recorded along the transect in 10-minute segments. On the ground an 8-mile segment was used.

Weather and Water Conditions

In the southern part of the Province all the snow disappeared from the ground quickly about April 15. The more northerly lake country, however, remained ice-bound in some cases as late as the end of May. Unseasonably cold weather has been experienced over Saskatchewan for most of this summer. Rainfall has been abundant although by no means evenly distributed over the Province. The south-east, and east-central, and northern parts of the Province received most of the showers.

Surface water conditions were excellent throughout the Province, except in the southwest parts of the northwest and west-central regions. Most depressions were full of water at the end of the survey, and little was being lost through evaporation.

The season was decidedly later in 1950 than it was in 1949; in fact there are indications that this might be the latest season in many years.

in general we feel that weather and water conditions over southern Saskatchewan were exceptionally favourable for the 1950 waterfowl population.

Breeding Population Trends

By the end of April most of southern Saskatchewan's nesting grounds were ready for their annual influx of waterfowl. At that time a series of low pressure areas with vigorous cold front activity swept across the northern tier of states bringing snow, freezing rains, and winds of gale force. The worst of this weather passed south and east of Saskatchewan, but it kept mean temperatures 10-15 degrees below normal over most of the Province. These storms passing across the flight routes of the Central and Mississippi Flyways brought all migration to an abrupt halt. On May 10, the Dakotas reported that many non-breeding birds were stalled there because of the weather. By May 12, the situation resolved itself and ducks began to move into Saskatchewan. The Dakotas then reported a "more normal" waterfowl picture, and the ground and aerial work in Saskatchewan started on May 14 and 15 respectively.

Table 1. -- Aerial Data Collected During 1948, 1949, and 1950

	1948	1949	1950
Flight Hours	81.2	87.0	60.0
Number of Transects	112	125	45
Total Survey Area	121,900 sq. mi.	121,900 sq. mi.	121,900 sq. mi.
Size of Sample	1,612.4 " "	1,347.3 " "	1,118.5 " "
Total Ducks Seen	30,300	15,402	14,772
Ducks per square mile	18.7	11.4	13.2
POPULATION TREND			
Compared with 1949			up 15.8%
Compared with 1948			down 29.4%
Total Water Areas	45,110	9,895	16,946
Water per square mile	27.9	7.3	15.4
WATER TREND			
Compared with 1949			up 110.9%
Compared with 1948			down 44.8%

Table 2. -- Data Collected by Ground Transect Method - 1948, 1949 and 1950 *

Period	Sq. mi. Sampled	Ducks per sq. mi.	Pairs per sq. mi.	Total water areas	Total No. pairs	Total No. ducks
May 11-June 10, 1948	687.4	17.3	8.9	11,010	6,155	11,920
May 5-21, 1949	687.4	10.7	4.7	2,679	3,225	7,400
May 14-29, 1950	687.4	16.3	7.4	8,375	5,120	11,055
	Increase $\frac{1950}{1949}$			212%	58%	49%
	Decrease $\frac{1950}{1948}$			23%	15%	4%

* Data adjusted so as to compare 1948, 1949, and 1950.

We found that the May waterfowl population of southern Saskatchewan was an improvement over the low population of 1949, but not as high as the 1948 population.

The pintail supply continues to be short. This bird was the most abundant duck in 1947 and 1948, and in 1949 it was down considerably in numbers. We assumed that the 1949 droughts in the southern part of the Province had caused a movement of pintails to areas of abundant water, but the species showed no recovery this year despite the abundant water and late breakup in the north. The mallard shows the most substantial increase in numbers in 1950. This bird is now the most abundant duck breeding in Saskatchewan, partly because of its own measurable increase, but perhaps chiefly because of the decline in numbers of its former competitors for the leading position. Blue-winged teal showed little change from its numbers in 1949. Baldpate showed a slight recovery over 1949 populations while the shoveler recorded no change. Divers were present in normal numbers with the redhead showing the best increase of that group.

This year's aerial survey took in more of the blank regions in the upper aspen belt and the edge of the coniferous forest than did the ground survey. The aerial transect averages can therefore be expected to run lower than those of the ground transects.

Best waterfowl populations were found in the southern part of the surveyed area in the short-grass prairie and the southeastern end of the aspen belt. Water conditions were very satisfactory in these regions, and in view of the late start of the 1950 season it is probable that many birds accepted the first good-looking pothole they could find rather than push further north. There is little evidence this year of a movement northward into the edge of the coniferous forest.

No broods were observed during the May coverages of the aerial and ground transects.

Success of the Season

The 1950 season got off to a very late start. No broods had been noted along the transects up to May 29, although some grouping of male mallards and pintails was observed. Broods were seen as soon as the second coverage got under way in earnest on July 10.

As this year was the first in which a brood count had been attempted from the air we have no aerial data from previous years that might be used for comparison with current figures. Because of the late start of the ground survey, and the short period within which we had to obtain the information, the ground work had to be simplified. The ground crew merely tabulated total adults and broods seen on the 1/4-mile strip over the transects. No effort was made toward "beating-out" areas because of the shortage of personnel and the limit on time. As it turned out, even with these simplifications, the ground survey required more than the allotted period for completion of the 3,500 miles of transects. There are, therefore, no ground data that can be compared directly with data from previous years.

Aerial data obtained during the July coverage are presented herewith in table form.

	Ducks/sq. mi.		Ponds/sq. mi.		Broods/sq. mi.
	May	July	May	July	July
Provincial Averages	13.2	5.8	15.4	5.7	0.9

Ground data obtained during the July coverage are summarized as follows:

Sq. Mile Sampled	Total Ducks	Ducks per sq. mi.	Total Broods	Broods per sq. mi.	Total water areas	Water Areas per sq. mi.
865	2,861	3.3	294	0.3	2,419	2.7

The difference in the number of broods seen per square mile between aerial and ground coverages is accounted for by the fact that the growth of vegetation by July made it impossible to see from the ground all the broods on an area when the area was not beaten.

The aspen belt, while taking third place in number of ducks per square mile in May, produced the largest number of broods per square mile during the July coverage. In this area of Saskatchewan the water levels are generally not subject to wide fluctuation. The water areas are also generally more heavily vegetated, tending toward less loss through evaporation and farming activities. The production of broods in Saskatchewan seemed to be in direct relation to the amount of available permanent water.

Of the 294 broods recorded on the ground coverage 85 were Class 1, 119 were Class 11, and 90 were Class 111. The 294 broods totaled 2,026 ducklings, or a brood average of 6.9.

Class 1 broods average 7.1 ducklings while Class 111 broods averaged 6.4. This would indicate an average loss of 0.7 ducklings per brood.

Broods of baldpate, blue-winged teal, and other late nesters were making a strong showing at the end of the July coverage. The outlook for mallards and pintails was not at all clear. The hens of these species disappeared from our transects after May 20, and we assumed that this indicated their first nesting attempt. Broods from this nesting attempt could be expected to appear in late June. However, preliminary runs of air transects, started on July 4, recorded only occasional Class 11 broods that could be identified with this first nesting attempt. By July 5 the aerial crew found mallards and pintails on their moulting lakes. The moult was well under way by the 8th, about the same date as in 1949, despite the general lateness of the 1950 season. From the banding data obtained on several of these moulting lakes it appears that many hens either made one unsuccessful nesting attempt or none at all. There was little evidence at the end of the July coverage of any important second nesting attempts among mallards and pintails.

Summary

During the 1950 waterfowl breeding season in most of southern Saskatchewan there was an abundant surface water supply. An unseasonably cool summer with adequate showers kept the breeding grounds in excellent shape in so far as moisture was concerned. Ducks were late in arriving in Saskatchewan, owing probably to very unfavourable weather passing across their migration route south of the International Boundary. When conditions appeared "normal" the aerial and ground survey work started and it was found that the breeding population of southern Saskatchewan showed some improvement over 1949 conditions.

Most of the waterfowl settled down in the extreme southern part of the Province, probably on the first suitable water area they came to. Because of the late start of the season, no broods were seen on the water up to the close of the May coverage.

There was evidence of a lack of, or an unsuccessful attempt at, first nesting among mallards and pintails. There was little, at the end of July, to show signs of any important attempt at second nesting by these two species. Other species appeared to be holding their own, or showing some improvement over 1949 production.

Indications are that Saskatchewan enjoyed a fairly good breeding season and production should be as good, or better than that in 1949.

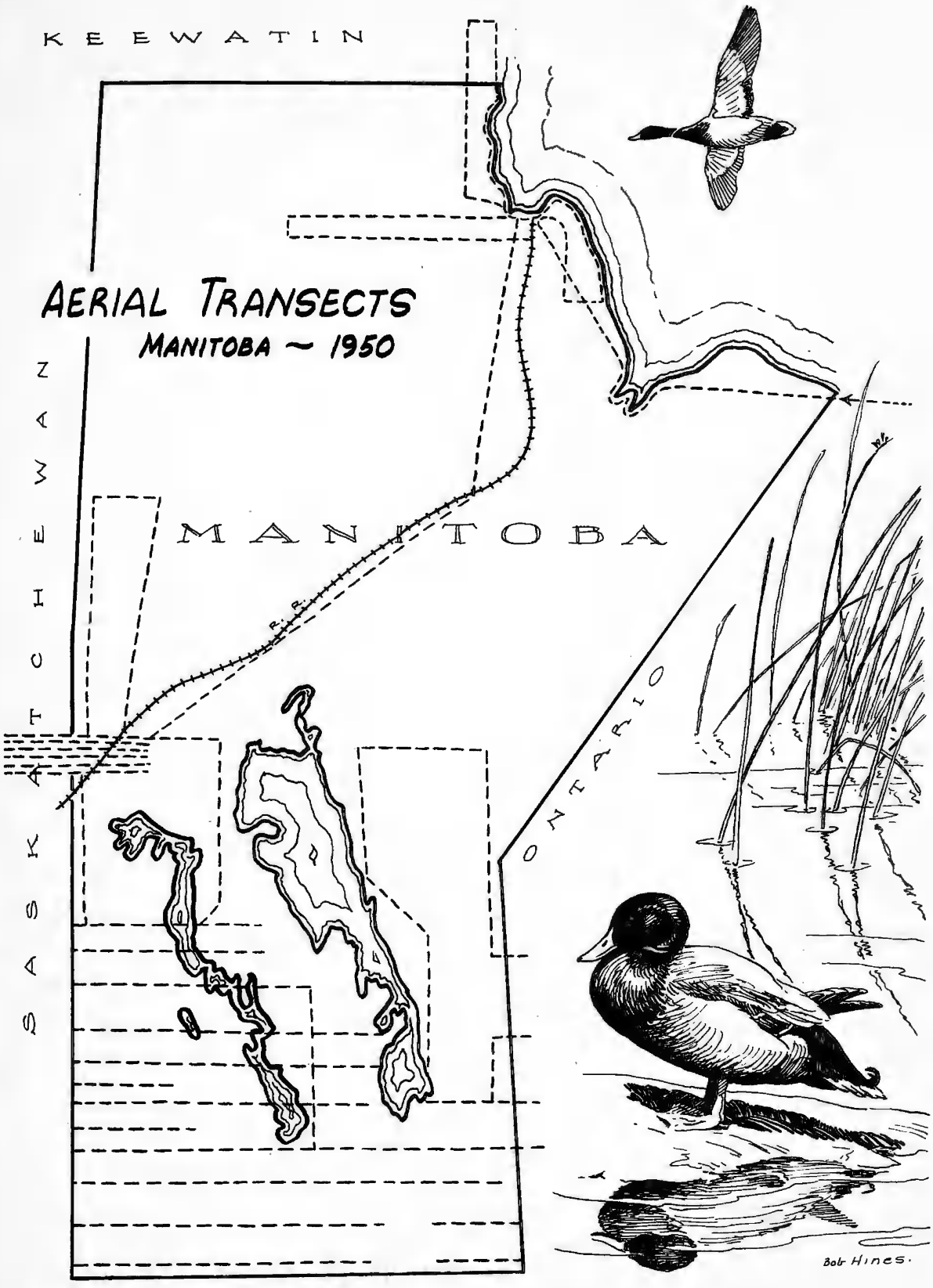
Banding

The 1950 banding operations in Saskatchewan were started on July 12, at which time large concentrations of moulting adult waterfowl were using Johnston and Eyebrow Lakes. There were practically no young birds available from the delayed early hatch, and prospects for banding juveniles were considered poor. Banding sites and the proper time to start the operation were determined by means of the U. S. Fish and Wildlife Service airplane, piloted by J. J. Lynch. The airboat was again found to be invaluable for moving equipment and driving waterfowl in these lakes.

In spite of all delays, and a shortage of equipment and personnel for a job of this magnitude, a successful banding program was completed on August 4. Some 5,410 ducks were banded on Johnston and Eyebrow Lakes. The following table shows the number, species, sex and age of all birds banded.

Species	Adult Male	Adult Female	Juv. Male	Juv. Female	Total
Pintail	1445	508	5	5	1963
Mallard	678	68	10	7	763
Blue-winged teal	842	103			945
Green-winged teal	1294	184			1478
Shoveler	114	17			131
Baldpate	115	6			121
Gadwall	3				3
Black duck	3	1			4
Cinnamon teal	1				1
Redhead	1				1
Ringneck	1				1
Coot					47
Eared grebe					21
Total birds					5478
Total ducks					5410

The banding crew, directed by F. Thompson, United States Game Management Agent, was made up of W. Paynter and J. Brownlee, Saskatchewan Game Branch Field Officers, and R. Lawhorn and C. Mueller, United States Game Management Agents. Members of the staff of the Saskatchewan Provincial Museum assisted in several drives. Dr. William Elder of the University of Missouri used his fluoroscopic equipment to determine the incidence of lead in the tissues of waterfowl trapped at Johnston Lake.


KEEWATIN
AERIAL TRANSECTS
MANITOBA ~ 1950
SASKATCHEWAN
MANITOBA
ONTARIO
Bob Hines.

Blank Page Digitally Inserted

WATERFOWL BREEDING GROUND SURVEY IN MANITOBA, 1950

Arthur S. Hawkins

This report summarizes the fourth annual survey of waterfowl, including their breeding numbers, their success, and the conditions under which they bred in Manitoba. In addition, it gives the results of a late summer banding program.

Personnel organization: Biologist J. B. Gollop (Canadian Wildlife Service) and E. N. Cole (Manitoba Game Branch) were the ground survey team. Flyway Biologists (U. S. Fish and Wildlife Service) W. F. Crissey and E. G. Wellein piloted the Sea-bee and Widgeon, used in the survey, with the author acting as full-time observer, and Charles Southwick (U. of Wisconsin and Delta Research Station) as part-time observer. W. H. Kiel (U. of Wisconsin and U. S. FWS) continued population and habitat studies in District 8, assisted briefly by Dr. R. A. McCabe and others (See appended report). Population and disease studies at Whitewater Lake were conducted by E. F. Bossenmaier (U. of Minnesota and U. S. FWS). D. G. Colls, and N. Neufeld (Canadian Wildlife Service), assisted by Kieth Storey (Ducks Unlimited). (See appended report). Conservation Officers of the Manitoba Game Branch who gathered the data submitted by Cole in an appended report, are named in that report. The staff of the Wildlife Management Institute stationed at Delta assisted in various phases of the survey. Operations, involving most of the above-named personnel, simultaneously for brief periods were the population and brood survey of the Rosneath study area and the banding drives at Whitewater Lake. Cole and Hawkins did the banding on Delta Marsh.

Scope

Except for minor changes caused by inaccessible roads, ground transects in 1949 and 1950 were the same. (Routes are given on a map in the 1949 report). Aerial transects, however, were re-organized this year (see map). Starting three miles north of the international boundary in Township 1, east-west transects across the Province were spaced at 24 mile intervals north to Township 37, except where an absence of fueling facilities caused gaps in this pattern and in District 8, where the intervals were 12 miles between transects. East of Lake Winnipeg and in northern areas a rectangular pattern was used. In the Saskatchewan Delta the transect interval was 6 miles. Two strips across North Dakota were run for comparison with the Manitoba counts.

Exploratory work this year included the Granville Lake area (north-western Manitoba at 56° 30') and the Tadoule Lake area, west of Churchill (58° 30'). Granville Lake is unique in that it has many small marshy fingers fairly well utilized by sport ducks. Duck densities were found to be considerably lower en route from The Pas to Granville Lake, west to Saskatchewan and returning via Flin Flon to The Pas. The habitat encountered on this trip was typical pre-cambrian rock country. Aside for local gathering of scoters and a few Canada geese, waterfowl were scarce from Churchill to Tadoule Lake and return by a more southerly route. This transect includes tundra, tundra-muskeg transition, and muskeg.

Methods

Data presented in this report were obtained as follows: (1) All transects were censused once for breeding waterfowl, using the standard transect method. Many of them were re-checked later in the nesting period and again near the peak of the brooding season. (2) In the better pothole country 10 percent of the areas (selected at random) received special attention. This semi-intensive coverage involved added efforts to see all waterfowl present, some nest hunting, the establishment of

water gauges, and in District 8, cover mapping. Later, the "beat-out" method was used to find broods. Most of the study areas were visited at least three times, some more often. (3) District 8, our best pothole country and the block used to test sampling methods was cross-checked by several methods: (a) regular east-west aerial transects across the district at 12 mile intervals; (b) aerial transects flown repeatedly over ground transect routes; (c) ground transects re-worked several times by Kiel and assistants; (d) other ground transects covered twice by Conservation Officer Krentz; (e) special study areas amounting to 10 percent of the total areas along Kiel's regular transects; (f) ten quarter section blocks scattered throughout the district; (g) the 1 1/2 section Rosneath study block combed by a 12-man crew for breeding pairs, nests, and later for broods. (4) Whitewater Lake's total population was measured by flying strips across the long axis of the lake at mile intervals (giving 25 percent coverage). Species composition was obtained from the ground using an air-thrust boat. (5) Large marshes were sampled by canoe or aircraft flying strips, usually at one mile intervals. (6) Shore lines and channels were covered on a duck-per-mile basis. Some of the methods employed are discussed in greater detail in the appendices.

Weather and Water Conditions

If abundant water were the only requirement of nesting waterfowl, ducks nesting in Manitoba would have had a "banner" year; they did not, however, in spite of the greatest spread of surface water in many years.

A leading meteorologist attributed the super-abundance of water in Manitoba (and Western Ontario) this year to unusually heavy rainfall which saturated the soil before the freeze-up last fall, unusually deep penetration of frost, heavy late winter and early spring snow, sub-normal April and May temperatures reducing evaporation, and heavy spring rains with a quick run-off. Many weather and flood records were broken during the course of these conditions. The net result on the waterfowl population was a two-week set-back in their entire migration and breeding chronology.

Sub-normal temperatures continued throughout the nesting and brooding season. May was particularly cold and wet, possibly a factor in the poor hatch. From July 12 to 15, when many broods were only a few days old, temperatures dipped almost to the freezing point, perhaps another factor affecting success. By the third week of August, a killing frost which caused considerable crop damage was recorded in Western Manitoba. For the period April 1 to August 14, which spans the nesting season, half of the crop reporting Districts in Manitoba listed a total precipitation figure 45-85 percent above normal, the remainder showed 15-30 percent above normal. This and the cool weather helped maintain most potholes in good condition throughout the nesting season.

Flooding has been a factor in reducing nesting success on several large marshes, including Netley and Delta, as well as in the area in western Manitoba which experienced a flash flood. On the favourable side, presumably, was the lateness of stubble plowing coupled with less than the usual amount of burning which should have reduced losses associated with farm operations of this type.

The combination of cool weather and high water may be responsible for the sharp decline in disease mortality which in 1949 brought serious losses among moulting ducks in Manitoba.

Population Statistics

Manitoba's highest duck densities are found in three areas: (1) the farmlands; (2) the Saskatchewan Delta; and (3) the large marshes. This prime duck habitat is restricted to the southwestern and western third of the Province. The remaining two-thirds of the Province contains numerous water areas, supporting a widely scattered

population of waterfowl, which in the aggregate may amount to a substantial number. In assessing population trends the prime areas are our first consideration.

Table (1) indicates an increase in the spring population of the farmlands in the neighborhood of 15 percent, an important part of which is in one species, the ruddy (Table 2). Our ground transects showed 16 percent, those of the Game Branch about 20 percent, and aerial counts 6 percent, as this year's gain. Table (1) arrives at a population index figure of 752,180 ducks for the 20,082 square mile block of farmland. Last year the comparable figure was 645,933. By this comparison this year's gain is about 106,000.

A comparison between 1949 and 1950 counts in the Saskatchewan Delta, which includes a small part of the Province of Saskatchewan, indicated a decline of 47 percent. (The Manitoba Game Branch found an even greater loss, about 70 percent, along their canoe transects). Total area of this Delta which we sampled (both Provinces) was 3,700 square miles. Applying the 1949 density figure (69.2) to the total size (3,700), the population index for the area is 256,040. The equivalent figure for 1950 is 134,310. The loss (the difference between the two) is 121,730. We concluded that the gain in the farmlands was more than off-set by losses in the Saskatchewan Delta.

The status of the third prime breeding habitat in Manitoba, the large marshes, is more difficult to assess. There are many reasons why this is so. Chief among these is the complex nature of the populations using marshes (See Bossenmaier's appended report). Scarcely has the spring migration ended when the post-breeding build-up starts, leaving only a few days when breeding numbers can be determined. Since the large marshes are widely scattered, the number that can be sampled at the proper time is limited.

Canoe and aerial comparisons between 1949 and 1950 on Delta Marsh place this year's increase at about 30 percent. Whitewater Lake counts for the nearest comparable phenological dates, showed a 15 percent increase this year. Two other marshes, Big Grass and Netley, indicated decreases. Record floods on Netley all but eliminated this important marsh as a breeding unit in 1950. Considering all the large marshes of southern Manitoba together as one habitat unit, it appeared that there was a slight improvement in breeding numbers this year as compared with last year.

Considering the three prime breeding habitats, (the farmland potholes, the Saskatchewan Delta, and the large marshes) our conclusion was that breeding numbers this year were not significantly different from those of 1949.

Table 1. -- Duck Population Changes, by Waterfowl Inventory Districts (Ground Transects Only) During the Period 1947-1950, in the Prairie and Parkland Farm Belt of Manitoba.

Dist. No.	Size / sq. mi.	Ducks per Sq. Mi. 1947	1948	1949	1950	Population Index * 1947	1948	1949	1950	% Change (1950vs1949)
1	1116	17.0	23.5	55.1	59.2	18,972	26,226	61,492	66,067	↗ 7.4
2	2412	7.4	12.9	32.8	32.0	17,849	31,115	79,114	77,184	— 2.4
3	1692	10.0	8.4	40.2	43.8	16,920	14,200	68,018	74,109	↗ 8.9
6	1512	28.0	18.3	36.2	45.7	42,336	27,670	54,734	69,098	↗ 26.2
7	3240	4.8	3.1	5.2	8.9	15,552	10,044	16,848	28,836	↗ 71.2
8	4134	25.5	33.6	86.3	101.2	105,417	138,900	356,764	418,361	↗ 17.3
18	5976	3.2	3.5	1.5	3.1	19,123	20,916	8,964	18,525	↗106.7
Total	20,082	11.8	13.4	32.2	37.5	236,169	269,071	645,933	752,180	↗ 16.4

*Obtained by multiplying the size of the district by the duck density found there.

Table 2. -- A Comparison Between 1949 and 1950 Species Densities * Along 153 Miles of Transect in the Principal Farm Pothole Districts (1, 2, 3, 6 and 8) of Manitoba.

Species	1949	1950
Mallard	11.3	12.4
Gadwall	2.3	2.0
Baldpate	3.5	3.3
Pintail	5.8	5.1
G-w. teal	1.4	1.8
B-w. teal	16.1	16.6
Shoveler	4.1	3.3
Redhead	2.2	3.1
Canvasback	3.1	3.4
Scaup	4.2	5.8
Ruddy	1.4	4.0
Misc.	0.6	1.1
Coot	9.2	8.5

*Expressed in terms of total numbers of each species per square mile.

Waterfowl habitats in Manitoba having lower densities than the "prime" areas are; the swamplands of southeastern Manitoba, the lowlands (interlakes country), the mountains, the rock country and the tundra. Only an airplane is suitable for sampling these areas due to their inaccessibility. In re-organizing this year's aerial transects, some exact comparisons with past years were lost. For example, in 1949, the density figure for the swamplands was 20.6 ducks per square mile. This year's figure was 3.0. We now realized that past samples were biased by including too much of the better duck habitat of the district. The decline, therefore, probably was less great than the figures show. How much less is not known.

In the four inventory districts included in the lowlands (11, 12, 15, and 17) population changes, from 1949 to 1950, were slight. In the four mountain areas sampled (Turtle, Riding, Duck and Porcupine) two showed gains and two losses. Conclusion: No change.

The rock country gave these results:

Table 3. -- A Comparison Between 1949 and 1950 Aerial Surveys on the Pre-Cambrian Shield of Manitoba.

Region	Sq. Miles Sampled		Ducks per Square Mile		Change
	1949	1950	1949	1950	
E. Lake Winnipeg	67.0	142.8	3.4	1.8	
N. of 54° Latitude	13.0	98.5	5.0	3.8	
Total	80.0	241.3	3.7	2.6	— 29.7%

For northeastern Manitoba, in the muskeg transition and tundra areas, interior to Hudson Bay, a population density of 4.2 ducks per mile was found in a sample of 231 square miles. This is higher than the 2.2 ducks per square mile reached in 1949 in a sample of 42 square miles. The two surveys were made at identical calender dates, but since phenological dates for the two years differed the results obtained are not exactly comparable. Along the Hudson Bay coast the 1949 count showed 42 ducks per square mile, as against this year's 29. Comparing the coastal and interior figures we would conclude that in 1950 the exodus of ducks, which had completed their breeding

activities, from the interior to the coast was less far advanced this year at the time of our survey, than in 1949, and that the total population of the area was about the same.

Considering all these regions of low duck density together, the conclusion is that the 1950 population was somewhat less than that of 1949. This coupled with the status of little change for the prime areas adds up to a downward trend in Manitoba's 1950 breeding numbers.

Production

For the second consecutive year, the duck crop in Manitoba (at least in areas where measurements were possible) failed to measure-up to advance billing (breeding duck count). This lack of correlation, in some years, between the potential (spring counts) and actual production (brood counts) makes it highly desirable, from the waterfowl management standpoint, to delay setting hunting regulations until nesting success can be measured in terms of growing ducklings.

It is worthy of special note that while the number of ducklings produced this year in Manitoba's finest pothole country was considerably below last year's production, neither nesting success data or brood size counts furnished a clue that a partial crop failure was in the making. This year 53 percent of all the nests under observation in pothole areas hatched, compared with 48 percent in 1949. Nests are found incidental to other field activities, hence the sample (181 nests) is too small to attach significance to the slight difference between the two years. The data seem to indicate that the degree of success was about the same both years. (See Table 4 in this report and Table 2 in the 1949 report.) The average brood size for all duck broods tallied was 6.7 in 1949 and 6.4 in 1950. For all practical purposes this average for the two years appears about the same. (Table 3 in the 1949 report and Table 5 in this report present the brood data by age classes.)

Appended reports of Kiel and Cole give details concerning the production drop of about 35 percent in Manitoba's best waterfowl area, District 8. In other districts containing numerous potholes we found a decline of 68 percent on 104 study areas spaced at random throughout these districts. Phenologically, the 1950 counts were made slightly earlier than the 1949 counts, hence late broods probably reduced the apparent degree of decline slightly.

Despite the general downward trend in breeding success, there were local areas where gains were recorded. The marshes at the south end of Lake Manitoba were one such locality. There, canvasback and redheads apparently had an unusually good season.

Aerial brood counts were made along most of the spring transects south of 54° but comparable data for 1949 are not available due to mechanical difficulties with the plane in 1949.

Reports reaching the Manitoba Game Branch office at The Pas, from their field officers, trappers, and transient biologists, were that production on the Saskatchewan Delta was not up to par and definitely below par in the north country. It was pointed out that the predator cycle is near its peak while the prey cycle is now low. Food is in great demand and, according to these reports, predation on duck nests has been unusually heavy.

Our conclusion is that Manitoba produced considerably fewer ducks in 1950 than in 1949. The production level now seems to be somewhere near that of 1948.

Table 4. -- Summary of 1950 Nesting Data *

Species	Total nests found	Total followed to completion	Number hatched	Number failed	Percent hatched
Mallard	45	41	17	24	
Gadwall	1	1	1	0	
Baldpate	1	1	0	1	
Pintail	6	2	2	0	
G-w. teal	2	1	0	1	
B-w. teal	12	10	3	7	
Shoveler	1	1	1	0	
Total dabblers	68	57	24	33	43.0
Redhead	15	14	5	9	
Canvasback	59	51	31	20	
Scaup	5	3	2	1	
Ruddy	34	18	14	4	
Total divers	113	86	52	34	60.5
All ducks	181	143	76	67	53.0

* Additional nesting data are presented in Bossenmaier's report on Whitewater Lake.

Table 5. — Summary of 1950 Brood Data*

Species	CLASS I No. Birds	CLASS I No. Young	CLASS I Average	CLASS II No. Birds	CLASS II No. Young	CLASS II Average	CLASS III No. Birds	CLASS III No. Young	CLASS III Average	TOTAL Birds	TOTAL Young	TOTAL Average
Mallard	31	199	6.4	6	48		20	119	5.9	57	366	6.4
Gadwall	10	92					2	17		12	109	
Baldpate	17	111	6.5	4	28		1	5		22	144	
Pintail	4	34		1	2		8	52		13	88	
G-w. teal	3	22								3	22	
B-w. teal	35	297	8.5	23	166	7.2	16	117	7.2	74	580	7.8
Shoveler	4	37		3	25		5	38		12	100	
Total dabblers	104	792	7.6	37	269	7.3	52	348	6.7	193	1,409	7.3
Ringneck	6	38					1	5		7	43	
Redhead	21	127	6.0				1	2		22	129	
Canvasback	56	309	5.5	43	205	4.8	37	216	5.8	136	730	5.4
Scaup	14	86					2	12		16	98	
Ruddy	33	203	6.2	6	29					39	232	
Golden-eye	3	20								3	20	
Bufflehead	3	22								3	22	
Total divers	136	805	5.9	49	234	4.8	41	235	5.7	226	1,274	5.6
All ducks	240	1,597	6.7	86	503	5.8	93	583	6.3	419	2,683	6.4

*Pothole areas only.

Banding

Drive-trapping of moulting adults on Whitewater Lake resulted in the following bandings:

Species	Adult Male	Adult Female	Young	Total
Mallard	48	0	0	48
Black duck	1	0	0	1
Pintail	1732	26	0	1758
Green-winged teal	112	2	0	114
Blue-winged teal	604	6	9	619
Shoveler	22	0	0	22
Total	2519	34	9	2562
Coot				18

Bait-trapping at Delta Marsh from August 13 to September 14 resulted in the following bandings:

Species	Adult Male	Young Male	Adult Female	Young Female	Total
Mallard	578	331	184	326	1419
Black duck	13	1	1	0	15
Baldpate	3	0	1	3	7
Pintail	28	65	29	71	193
Green-winged teal	4	9	1	7	21
Blue-winged teal	73	1284	36	1349	2752
Shoveler	0	0	0	1	1
Redhead	0	71	9	72	152
Canvasback	0	3	7	2	12
Scaup	0	0	0	1	1
Total	699	1764	268	1832	4573

Summary

The waterfowl migration and breeding schedule in Manitoba averaged two weeks later than usual due to a late break-up and a cold, wet spring. A tremendous run-off resulted in a super-abundance of surface water. Low evaporation rates and frequent rains permitted most potholes to remain full throughout the summer.

In southern Manitoba an increase in breeding ducks approximating 15 percent was recorded. This was off-set, however, by reduced numbers further north. All parts of Manitoba considered, the trend in breeding stock was downward.

In southern Manitoba, despite increased breeding numbers, production dropped below the 1949 level. Northern Manitoba also apparently fared badly in producing waterfowl. For the Province as a whole, the trend was downward.

As a part of the breeding ground survey, 7,135 ducks were banded.

WATERFOWL BREEDING GROUND SURVEY
BY
MANITOBA GAME BRANCH CONSERVATION OFFICERS, 1950

E. N. Cole

In 1950, for the third consecutive year, Manitoba Conservation Officers, directed by G. W. Malaher and A. P. Davey, made waterfowl counts along fixed transect lines. A map showing the location of these transects is presented in Special Scientific Report: Wildlife No. 2 (1949) facing page 70. The following tables show comparison of data obtained in 1948, 1949, and 1950.

Inventory Districts 1, 2, 3, and 8

(Farmland pothole country) - The figures show ducks per square mile.

YEAR	I.D. 1	I.D. 2	I.D. 3	I.D. 8	All I.D.'s	% Inc. or Decr.
1948	23.6	13.3	8.1	43.8	18.0	
1949	53.5	38.6	35.5	74.1	49.2	+ 173.3 %
1950	77.5	61.0*	24.6	79.4	59.9	+ 21.7 % *

*It is evident from Conservation Officer Serafin's report that his figures happened to include a mass movement of blue-winged teal through the district. Biologist figures from the same district obtained shortly before and shortly after Serafin's counts, agree closely except in blue-wings. If a correction is applied for this discrepancy, the rate of increase indicated (21.7 percent) drops from 12 to 15 percent.

Delta Marsh

Ducks per mile of Transect:

Year	May	June	
1948	51.9	59.0	
1949	94.6	49.3*	
1950	--	63.3	28% Increase.

* In Special Scientific Report: Wildlife No. 2, this figure is shown to be 40.1. This is a typographical error.

Netley Marsh

Netley Marsh showed an increase of 53.3 percent in 1949 over 1948. This year, due to extremely high water levels, coverage of regular transects was impossible, but a marked decline was apparent.

Saskatchewan River Delta

Year	Ducks per Mile	% Incr. or Decr.
1948	10.2	---
1949	32.4	+ 217.6 %
1950	9.3	— 71.3 %

The over-all picture indicates that although the population increased in the southern areas of the Province, a substantial loss in the north offset this increase.

The Brood Surveys of the Conservation Officers in southwest Manitoba were not completed this year due to bad weather and other important jobs pressing at the time. Some information was obtained from Districts 2 and 3, and it showed a substantial decrease in broods. The degree of decrease could not be determined from the data obtained. However, in District 8, Conservation Officer Krentz was able to complete his survey, and his report is quoted below:

Duck Transects - Summary Minnedosa Pothole Area

The writer begs to report on the brood count of ducks in the above area. Survey began on July 21 and was completed on August 2, 1950.

Upon examining the information gained from the transects and comparing them with last years results, it was found that an alarming decrease exists in some areas. The following table shows the number of broods by transects with comparing numbers of last year.

Transect	1949	1950	Change
Neepawa to Minnedosa	18	6	Decrease 66%
Brookdale to Cordova, #10 Highway	73	19	" 74%
#4 and 10 Highways West to Mile 99	30	24	" 20%
Rapid City to Basswood	31	28	" 10%
Shoal Lake to Hamiota	83	61	" 28%
Decker to Beulah	31	16	" 50%
Binscarth to Angusville	35	39	Increase 11%
TOTAL	301	193	Decrease 36%

It will be noted that all transects show a decrease with the exception of the last one which shows a small increase. Upon examining the transect information further by species, it is found that mallards and pintails are responsible for the decrease. All other species show increases or hold on a par with last year. All species, with the exception of pintails show an increase on the last transect (Binscarth to Angusville). The following table shows the brood comparison of mallards and pintails.

	Mallards		Pintails	
Transect	1949	1950	1949	1950
Neepawa to Minnedosa	9	1	5	1
Brookdale to Cordova	19	3	9	0
#4 and 10 Highways West to Mile 99	13	5	8	2
Rapid City to Basswood	11	6	4	2
Shoal Lake to Hamiota	29	12	12	6
Decker to Beulah	14	7	7	0
Binscarth to Angusville	12	13	7	4
TOTALS	107	47	52	15
Over-all Decrease		56%		82%

With the season so far advanced there can be little or no change in the mallard or pintail situation, although some spoonbill, teal, and ruddy ducks are still to hatch. Broods by age classes show that there are no mallards or pintails in the Class 1 or downy state.

Officer Krentz's transects are located in the same Inventory District as those surveyed by Mr. Kiel, but the routes covered are different in all cases. It is therefore of interest to note that Kiel arrived at a decrease of 34 percent, closely comparable to Krentz's findings.

As further evidence of this decrease, two biologists conducting a different type of survey (complete coverage of 10 quarter-section blocks in the same inventory district) obtained a 36 percent decrease in broods. Both officer Krentz and Mr. Kiel agreed that late hatches would not lessen the decrease to any appreciable extent.

The officers who have assisted the biologists in the task of appraising the waterfowl population of this Province are as follows:

Saskatchewan River Delta:	E. Lambert, J. G. Reader, N. McKenzie, A. D. Clark, T. E. Iles, G. W. Clark, R. B. Beck, B. Bercier, Mr. Azure.
Delta Marsh:	W. L. Newman, D. J. McIntosh, C. Batten, R. Ward, L. O'Niell.
Netley Marsh:	T. H. Schindler, G. Shand, T. L. Couture.
Southwestern Manitoba:	H. Krentz, R. Gilmore, J. Serafin, G. Parsons, W. J. Goodey, H. F. Henderson.

WATERFOWL BREEDING POPULATION AND PRODUCTION IN MANITOBA INVENTORY DISTRICT NO. 8

William H. Kiel, Jr.

For a second year, waterfowl production has been studied in Manitoba Inventory District No. 8. One phase of the project is a study of methods of predicting and measuring production in pothole habitat. The sampling procedure and the district are described in Special Scientific Report: Wildlife No. 2 (1949).

This report presents the breeding population and production data that are comparable for 1949 and 1950.

Methods

As in 1949, 12 transects, each composed of 100 potholes, formed the basis for sampling the waterfowl breeding population and production in this district. Ground transect breeding-pair and brood census methods used to obtain the data given in this report were the same as used in 1949.

Other methods used to measure the breeding population and production are special-study potholes, quarter-section blocks, aerial transects, and ground transects of the Manitoba Game and Fisheries Branch. Special-study potholes represent a random ten-percent sample of the 1,200 potholes on ground transects. Ten quarter-section blocks, located adjacent to transects, are a means of comparing transect results with another method of censusing waterfowl populations.

Aerial coverage of the district was intensified this year. Transects were flown at frequent intervals during the breeding season over the exact routes of ground transects. Another phase of aerial coverage involved east-west routes flown at two-township intervals across the entire district.

Permanent ground transects of the Manitoba Game and Fisheries Branch offered a direct comparison with ground transects used in this study.

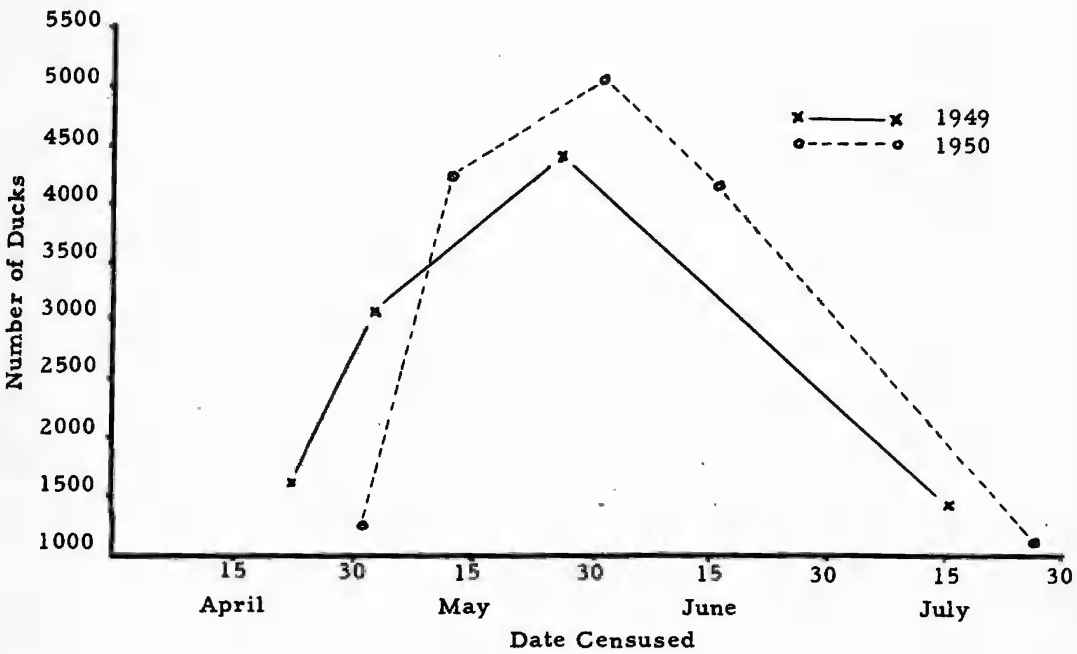
Discussion

In District 8, waterfowl were late in arriving on the breeding grounds (Figure 1). A few pairs of mallards and pintails were present on transects in late April, but there was no real influx of ducks until the first week of May. Thereafter the build-up was rapid with the peak in the breeding population coming about May 27. Figure 1 indicates that the peak in population was about May 25 in 1949. It is felt, however, that this peak in 1949 was caused by birds moving into southwestern Manitoba from the drought areas of provinces to the west, and that the peak of the normal breeding population in District 8 was about May 10.

Table 1 compares the breeding populations for 1949 and 1950 and indicates an increase of 15-17 percent. In terms of total ducks, blue-winged teal and ruddy ducks made up 14.1 percent of the 17.3 percent increase over 1949. The increase in ruddy ducks is not reflected in the breeding-pair comparison because at the time of census most ruddies were still in courting groups.

Table 2 is a comparison of production and age-class distribution of broods for 1949 and 1950. Broods of species not included in this table follow the general trend shown here. An indicated 34 percent decrease in number of broods was offset

Figure 1 -- Phenology of Waterfowl Population
District 8, 1949-1950



Blank Page Digitally Inserted

Table 1. -- Breeding Populations, 1949-1950 (12 transects-50.4 square miles)

Species	Breeding Pairs 1949 May 14-June 6	Breeding Pairs 1950 May 26-June 1	Percent Change For each Species	Percent Change In terms of total for all species
Mallard	382	416	+ 8.9	+ 1.7
Pintail	113	141	+24.8	+ 1.5
Baldpate	181	181	--	--
Gadwall	112	97	-13.4	- 0.8
Shoveler	104	116	+11.5	+ 0.6
B-w. teal	476	643	+35.1	+ 8.7
G-w. teal	88	104	+18.2	+ 0.8
Canvasback	136	124	- 8.8	- 0.6
Redhead	106	126	+18.9	+ 1.0
Ruddy duck	43	46	+ 7.0	--
Lesser scaup	140	142	+ 1.4	--
Others	33	69	+109.1	+ 1.9
Total pairs	1,914	2,205		+ 15.2
Pairs per Square mile	38.0	43.8		
Total ducks	4,351	5,102		+ 17.3
Ducks per Square Mile	86.3	101.2		

Table 2. -- Production and Age-Class Distribution of Broods, 1949-1950 (7 transects)

Time of Census - July 5-24, 1949

Species	Age Class 1	Age Class 11	Age Class 111	Total	Percent of Total
Mallard	7	9	12	28	13
Pintail	2	4	14	20	9
B-w. teal	20	8	12	40	19
Baldpate	12	8	1	21	10
Gadwall	10	3	0	13	6
Canvasback	26	23	13	62	29
Redhead	8	3	2	13	6
Ruddy	18	0	0	18	8
Total	103	58	54	215	
Percent in Age Class	48	27	25		

Time of Census - July 24-27, 1950

Species	Age Class 1	Age Class 11	Age Class 111	Total	Percent of Total
Mallard	4	3	5	12	9
Pintail	2	1	6	9	6
B-w. teal	13	8	3	24	17
Baldpate	8	2	2	12	9
Gadwall	3	0	0	3	2
Canvasback	28	23	5	56	40
Redhead	10	0	0	10	7
Ruddy	15	0	0	15	11
Total	83	37	21	141	
Percent in Age Class	59	26	15		

slightly by late-hatched ruddy, redhead, and blue-winged teal broods appearing after the brood survey was made. However, such late broods of ruddies and redheads, some in Class 1 on September 1, will not reach flying stage before the hunting season opens. The greatest decline appears in the puddle-duck species. It is probable that repeated heavy rains combined with a late, cold spring caused the poor success of land-nesting species.

Re-checks of transects after the original brood survey revealed that, by August 4, 48 percent of the broods were in Class 111. Average brood size was approximately the same in District 8 for 1949 and 1950.

Water levels measured with gauges in the 120 special-study potholes were higher than in 1949. Levels were high in early spring and remained so with little fluctuation during the summer over most of the district. There was no apparent indication that high water levels made diving-duck nesting habitat less desirable in the potholes. New growth of aquatics was especially dense.

In addition to furnishing water level data, special-study potholes were the source of data on vegetation changes in the potholes and land-use practices around them.

Nest and brood data gathered in District 8 are included in the Manitoba report.

Summary

A second-year study of waterfowl productivity in Manitoba Inventory District 8 revealed that a 15-17 percent increase in the breeding population did not result in a corresponding increase in production. Instead, a 34 percent decrease in number of broods was indicated by July brood surveys comparable for 1949 and 1950. Late-hatched broods offset this decrease only slightly. Apparently, repeated heavy rains combined with a late, cold spring caused the poor production.

Water levels in April 1950, were higher than in April 1949, and remained higher throughout the summer over most of the district.

Methods being used to measure waterfowl breeding populations and production in District 8 included ground transects, special-study potholes, aerial transects, and quarter-section study blocks.

WATERFOWL INVESTIGATIONS AT WHITEWATER LAKE, MANITOBA - 1950

Eugene F. Bossenmaier

Whitewater Lake, located at the northern base of the Turtle Mountains in southwestern Manitoba, is one of the major moulting areas for dabbling ducks in the Province. During the past five summers an estimated 85,000 waterfowl perished on the lake (See Special Scientific Report: Wildlife No. 2), and a relatively minor sickness recurred again this season.

Proper management of the lake has been uncertain because essential physical, climatological, and biological information needed to understand the duck sickness was not available. Furthermore, the influence that will probably be exerted on the choice of a course of management by the numerous interests associated with the area was not known.

The investigations that began in April of this year had as their objectives a knowledge of the duck sickness and of the waterfowl populations and utilization of the lake, as well as a better understanding of all interests concerned with the area.

The study was organized as a part of the cooperative waterfowl investigations in Manitoba for 1950. Organizations assisting were the Canadian Wildlife Service, Ducks Unlimited (Canada), United States Fish and Wildlife Service, Manitoba Game and Fisheries Branch, Wildlife Management Institute through the Delta Waterfowl Research Station, and the University of Minnesota.

Field work was undertaken by the first three organizations mentioned. The Canadian Wildlife Service studied aspects of the duck sickness and their findings will be given separately. Ducks Unlimited (Canada) operated the duck hospital in the village of Whitewater. This report will present a brief summary of the phases pertaining to the waterfowl populations and utilization of the lake, and of the conditions of climate and habitat as they existed during the season.

Area Description

Whitewater Lake is roughly rectangular in outline, lying with its long axis in a west-southwestern direction. This year the lake, including flooded marsh lands, is approximately twelve miles long and four miles wide, covering some 25,000 acres. (See accompanying map)

The average depth of the lake is four feet, with five and one-quarter feet being the deepest area sounded. The shore, except for restricted areas, is characterized by wide stretches of feather-edge, in fact, along much of the shoreline a depth of three feet does not occur for a distance of a half mile or more from land.

The lake proper is relatively free of emergent vegetation except for scattered hardstem bulrush (Scirpus acutus), and cattail patches (Typha latifolia and T. angustifolia), and for dense stands of the same species plus reed grass (Phragmites maximus) in the southwestern, eastern, and northeastern sections of the lake. The lake proper is adjoined on the east by a flooded whitetop (Fluminea festucacea) marsh (average depth ten inches) covering approximately seven square miles, and on the southwest by a similar marsh of about two square miles.

Five islands and an exposed mud bar are present on the lake. The narrow and curved 210 acre wooded island situated in the north-central portion of the lake is considered "The Island" by the local residents. The other four islands are vegetatively

similar to the mainland from which they are severed by a water depth of only several inches. The mud bar is narrow and discontinuous with a maximum height above water of eight inches. It lies between the lake proper and the eastern marsh.

Area Interests

Although conservation agencies and many of the local residents agree that management of the lake to prevent future duck losses is of utmost importance, other interests associated with the lake cannot be disregarded.

Whitewater Lake is a Fur Rehabilitation Block controlled by the Manitoba Game and Fisheries Branch and has in previous years produced the finest muskrat pelts in the Province. The lake is a Public Shooting Ground and as such is a concentration area for hunters in the fall, drawing men from as far away as Winnipeg and from many points below the border.

Grain farms occupy all land surrounding the lake and crop depredation problems have arisen in past years. Farmers in the region benefit in years of low water from the hay and pasture lands adjoining the lake. Local residents strongly believe that good crops in the district are partially attributable to a rain drawing power of the lake, and also to the large breeding population of Franklin's gulls that feed on the farmland.

Weather and Water Conditions

The arrival of spring this year was the latest in the memory of local residents. Although the earliest mallard and pintail found open water the beginning of April, the lake was not entirely ice free until May 15. The season continued cooler and wetter than normal, except for an occasional hot and dry period, until the last part of August when the area experienced its first prolonged period of normal summer weather.

The water level of Whitewater Lake is controlled by spring run-off, mainly from the Turtle Mountains, and summer precipitation, and by evaporation and possible seepage; there is no outlet nor constant inlet. The level on April 15 of this year was within one inch of the August, 1949 level. Heavy spring run-off raised the level sixteen inches by May 15 which was a higher level than at any time since the turn of the century. Up to September 1 the level had dropped five and one-half inches, a summer lowering much less than normal and undoubtedly a result of the cool and wet season.

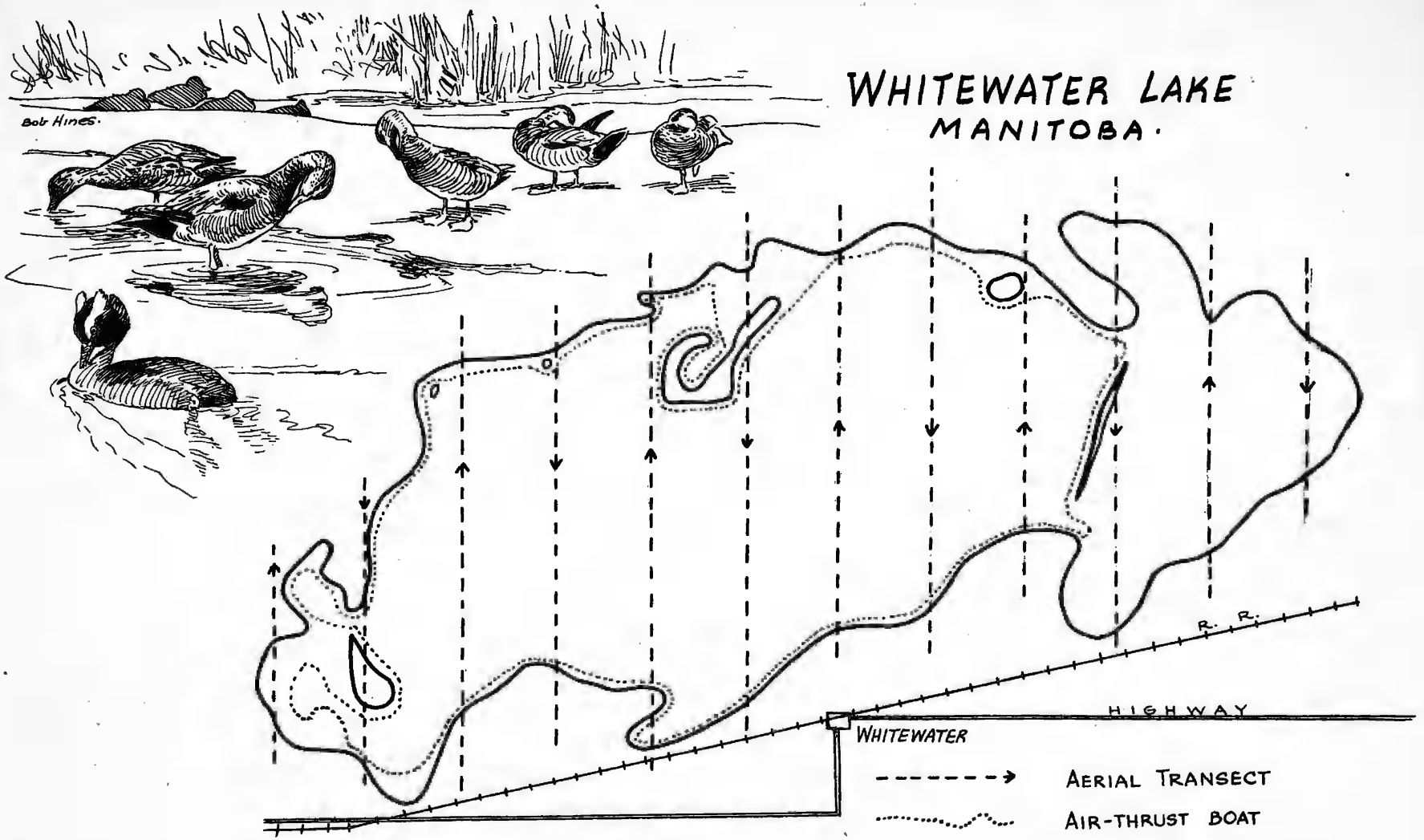
Duck Sickness

A die-off developed on the lake coincident with the arrival of the first diving duck species about April 20. Before it ceased towards the end of May an estimated 3,000 birds had perished. Ninty percent of the affected birds were lesser scaup, with other diving duck species comprising most of the remainder.

Three minor outbreaks of duck sickness occurred during the summer; in mid-July, mid-August, and in the first week of September. They claimed the lives of an estimated 1,500 waterfowl, of which 95 percent were dabbling ducks.

Breeding and Production

A shoreline count of breeding pairs and lone drakes of dabbling ducks was made in conjunction with intensive nesting and brood surveys in an attempt to arrive at production figures for 1950.


Bob Hines.
WHITEWATER LAKE
MANITOBA.
R. R.
HIGHWAY
WHITEWATER
AERIAL TRANSECT
AIR-THRUST BOAT

Blank Page Digitally Inserted

The count was made from an air-thrust boat on May 21, which was after most of the migrant birds had departed and before the arrival of the summering population. It was conducted along the 13 miles of shoreline where visibility was not impaired by dense vegetation. The average pair and lone drake count per mile was 4.0 blue-winged teal, 2.2 gadwall, 2.0 mallard, 1.9 shoveler, 1.7 pintail, and 0.5 baldpate for a total of 12.3. An influx of paired birds the first part of June altered the figures and probably resulted in a change in the species composition and density of the breeding population around the entire lake.

Intensive nesting surveys were conducted in each of the following cover types:

1. The extensive whitetop marshes that adjoin the lake on the east and southwest.

2. The emergent vegetation of the lake proper.

3. The prairie vegetation bordering the lake.

4. The shrub vegetation (Symphoricarpos occidentalis, dominant) on the 210 acre Island.

5. The farmland within one-half mile of the water's edge.

The whitetop marshes provided nesting cover for several species of ducks and was the preferred cover of redhead, pintail, and ruddy. Known nest density was as high as 110 to the quarter section in the best area.

The sparse emergent vegetation of the lake proper was only slightly utilized by breeding diving ducks. An intensive search throughout the nesting season located only three redhead and two ruddy nests.

The prairie vegetation of the dry portion of the old lake bed and the farmland surrounding the lake supported a nesting population approaching the figure of 12.3 pairs and lone drakes per mile of shoreline obtained by the air-thrust boat count.

The dense shrub stands on the Island were the preferred nesting cover for baldpate, and gadwall, and were utilized by all species of dabbling ducks nesting on the lake. Known nest density was one nest to eight acres.

A total of 327 nests were located in the 5 cover types. Nest success based only on positive hatches and positive desertions and destructions was 33 percent.

Brood surveys were conducted from the water using an air-thrust boat and from the land by walking portions of the lake shore. A total of 164 brood observations were made on the lake proper between June 29 and August 31. All attempts made to survey broods in the dense whitetop marshes failed, but on several occasions injury-feigning hens were flushed.

The figure of 164 includes every brood seen regardless of whether it was recorded previously. Approximately 72 of the 164 were second and third records, making 92 the approximate number of new broods seen. The species composition of the 92 broods was 41 blue-winged teal, 16 redhead, 10 gadwall, 9 pintail, 7 shoveler, 3 ruddy, 2 canvasback, 2 baldpate, 1 green-winged teal, and 1 mallard.

Populations

The number of waterfowl on Whitewater Lake was obtained by aerial transects on an average of once every nine days from May 12 to August 1. All waterfowl seen along quarter-mile wide transects located along section lines were counted, giving 25 percent coverage. Weekly air-thrust boat trips around the shore of the lake were made from May 7 to September 1 in conjunction with the aerial flights to obtain the species composition of the population, areas of utilization, and progress of the moult. (See accompanying map for location of air and water routes.)

The migrant population reached a peak (15,000) the first week in May. By the end of the month the population (3,000) consisted of the breeding population and residual migrants. Summering drakes began arriving the first week in June and their peak number (70,000) was attained about the end of July.

The first flightless mallard was observed on June 22. The peak of the flightless period for the summering population as a whole was towards the end of July. Relatively few birds were still flightless on September 1, but several thousand gadwall and many hens of all species had not yet completed the primary feather moult on that date.

Due to space limitations some subjects were only briefly discussed in this report, and others that are more involved were necessarily omitted. The findings of the entire study will be presented more fully in a forthcoming report.

NOTES ON THE CHRONOLOGY OF THE 1950 WATERFOWL NESTING SEASON IN SOUTHERN MANITOBA

Lyle K. Sowls

The proper interpretation of breeding ground surveys in the exceptionally cold and late spring of 1950 partly depends upon an understanding of the lateness of the season and its effects upon nesting chronology. The spring of 1950 was one of the latest and coldest ever recorded in central Canada. What effect did this abnormal weather have in delaying nesting? Did it shorten the nesting season and thus reduce production by limiting the number of opportunities for renesting?

Along with studies of nesting behavior, migrational homing, nesting ecology, and renesting, an effort to compare the chronology of the nesting seasons is being made at the Delta Waterfowl Research Station through intensive study. The starting date for all nests found has been determined by the aging of the embryos and back-dating by the age of the embryo plus the number of eggs in the nest to arrive at a beginning date. The plotting of these beginning dates then gives a curve of the nesting chronology for the season. To accomplish the aging of the embryos, one egg from each nest was taken and its embryo compared with an embryo of known age in the station collection which has been made up from incubator eggs.

It is the purpose of this report to compare the years 1949 and 1950 from the standpoint of nesting dates and to speculate on the meaning of the comparison.

For this purpose the nesting curves of three species (mallard, pintail, and blue-winged teal) are shown in Figure 1. These curves give the percentage of the total number of nests found which were started in each of the week-periods of the nesting season. In the construction of these curves only one assumption is made that the amount of effort in finding nests was the same for each year. To be certain that the assumption could safely be made, repeated nest-hunts were made in the same manner for both years beginning as soon as the ducks arrived in spring and continuing until after repeated searches yielded no nests at all. The majority of the records used were gathered on the special study area at Delta where other intensive work is being done.

For some species there are other means of determining the end of the nesting season, and it is also possible to get information about the percentage of hens which were unsuccessful nesters. In 1950 the end of the nesting season, as indicated in Figure 1, was followed closely by an influx of pintails into the Delta marsh. This population did not consist entirely of males as would have been the case had all hens been successful in hatching broods or had unsuccessful hens been still renesting. For one small water area within the study area counts of pintails were begun as soon as the influx became apparent and were continued until the drakes were so far into eclipse plumage that they could no longer be identified from females. These counts over a period of 10 days are given in Table 1.

Figure 1. -- Nesting Chronology of Mallard, Pintail, and Blue-winged Teal for the years 1949 and 1950, Determined by the Percentage of Nests Started by Weeks of the Season.

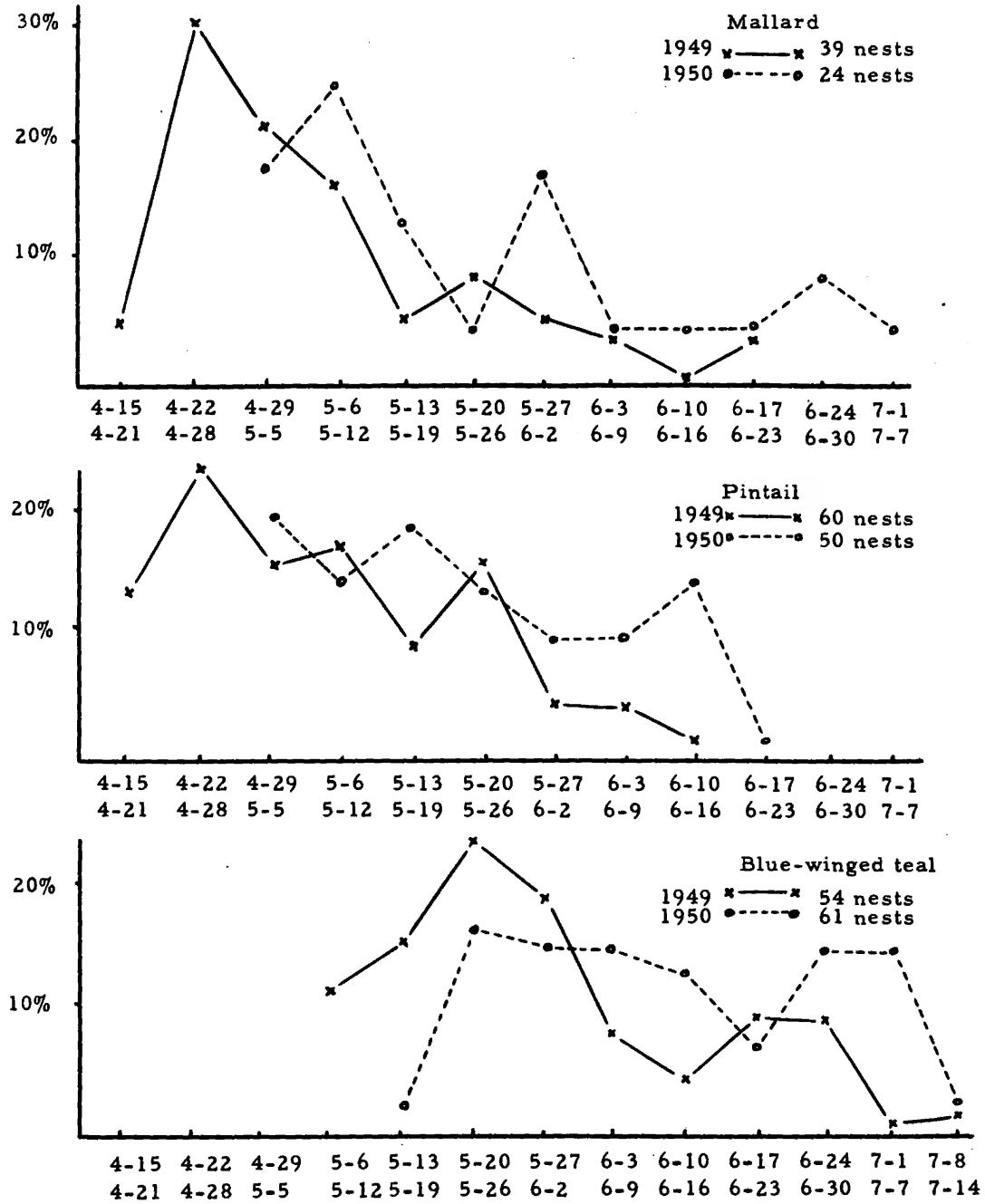


Table 1. Sample counts on the sex-ratio of pintails in post-breeding season gatherings at Delta, 1950

Date	Drakes	Hens	Percentage of hens
June 13	52	24	32
14	68	19	22
15	60	18	23
16	73	26	26
19	70	20	22
20	93	26	22
23	104	34	25
Total	520	167	Av. 24

Conclusions

From the graphs in Figure 1, it is apparent that mallards and pintails began nesting in 1949 during the week of April 15-21 but that in 1950 they began about two weeks later. There is some indication that in these two species the season was extended at the end by approximately the amount it was delayed at the beginning.

In the case of the blue-winged teal, a later nesting species, the delay was one week only. With this bird the season was apparently extended the amount it was delayed.

Thus it would appear from these data that for the Delta region the lateness of the season did not seriously reduce nesting opportunity. For these early and comparatively rapid-developing species the season was not so late that large numbers of young would be unable to fly at freeze-up time.

For adult hens which have to moult after the young are grown, however, it may mean a moulting period so short that they will not have time to grow new primaries.

Large numbers of pintail hens were seen in mixed gatherings just as the nesting season came to a close (as determined in Figure 1). Sample counts on one area showed that from seven counts, 24 percent of the birds were hens. These hens were apparently unsuccessful nesters who were no longer trying to renest, as all successful hens should be with broods or on nests.

WATERFOWL BREEDING GROUND SURVEY IN ONTARIO - 1950

Arthur S. Hawkins

Coverage of the better waterfowl breeding areas in Ontario, which in 1949 included a few marshes in the southern part, this year was extended to all parts of the Province. Western Ontario, according to banding returns, is the best mallard-production area of the Province. This portion of the Province was sampled by plane along transect lines connecting with several in Manitoba. (Locations of the transect lines are indicated on the attached map).

A survey of the James Bay - Hudson Bay coastal area in Ontario is discussed in a separate section of this report. Our findings along the newly-established east-west transects and the results of surveys undertaken by the Fish and Wildlife Division of the Ontario Department of Lands and Forests are summarized in this section.

The weather in northern and western Ontario was similar to that described for Manitoba; ice left the lakes at an unusually late date, the spring was cold and wet, and water levels were unusually high.

Along the aerial transects, which included 117 square miles of Pre-Cambrian country, the average density was 2.7 ducks per square mile. Mergansers and golden-eyes composed about two-thirds of this total; mallards and scaup nearly one-third.

Conservation Officer Reports

Twenty-five Ontario Conservation Officers' reports were received from two areas: 15 from that part of the Province between Lake Ontario and the Ottawa River, and 10 from that including Manitoulin Island in Lake Huron north to approximately 48° north latitude. These reports indicated arrival dates by species and approximate numbers seen, dates and numbers at the peak of migration, and any nesting or broods seen. The opinion of each officer regarding the status of waterfowl this year compared to that of last year was sought.

In the Quinte-Pembroke districts north of Lake Ontario, migration apparently averaged a week earlier than in the Manitoulin - Chapleau area. The flight peak in mallards and blacks fell during the last half of April in both areas. In Canada geese the flight peaks also were about a week apart (last week in April and first week in May). Opinions as to the status of ducks as indicated by these reports follow:

	Migration			Nesting		
Area	More	Less	Same	More	Less	Same
North of L. Huron	5	0	4	3	2	4
North of L. Ontario	5	3	5	2	3	8
Total	10	3	9	5	5	12

Opinions were likewise varied as to the migration status of geese: 8 showed increases, 3 decreases, and 10 no change. One might conclude that no wide-spread change in status occurred in either ducks or geese this year as compared with last year in these areas.

AERIAL CENSUS - WESTERN ONTARIO
1950

---------- ROUTE

NOTE: see seperate report covering James and Hudson Bay for additional aerial coverage in Ontario.

Blank Page Digitally Inserted

Breeding Records

Mr. H. G. Lumsden, Ontario biologist, appraised the waterfowl production of selected marshes and lakes of the Quinte District (latitude 44° - 45° 30'; longitude 76° - 77° 30') between June 2 and August 9. He made use of car, boat, plane, and a trained retriever in this survey. Extracts from his report follow:

Pre-Cambrian Lakes and Marshes

Duck breeding densities were low throughout. A few black ducks breed along marshy creeks and beaver meadows or in the small shallow bays of lakes which are mostly cold and deep. This habitat occupies the northern half of the district. One important duck marsh (Conroy Marsh), covering five square miles, occurs in this habitat. On it the following broods were counted during two visits: Black duck 2; ringneck 14; wood duck 1; hooded merganser 4; golden-eye 3. It was the opinion of the observer that he saw most of the ringneck brood but probably missed most black and wood duck broods. Brood density on the half of the marsh which could be surveyed was 7.2 per square mile. The average size of 11 ringneck broods was 4.5 young per brood.

Limestone Lakes and Marshes

Although surveyed too late for a proper appraisal, indications were that these waters were quite productive. Black ducks are probably the most common nesters, with mallards second. Gatherings of fully-grown black ducks, mallards, wood ducks and blue-winged teal were encountered late in July and early in August, but some broods of these species still were in evidence, indicating local production.

Cattail Marshes along Lake Ontario

Cattail marshes, where creeks empty into sheltered bays of Lake Ontario or the Bay of Quinte, and sandy basins formed by bays cut off from the Great Lakes proper also form habitat more or less attractive to breeding ducks depending on the development stage of the vegetation. Black ducks, mallards, blue-wings and wood ducks are the main species using these areas.

Quinte District

The 46 broods containing 214 young (4.7 each) found during the survey of the Quinte District were of the following species:

Species	No. Broods	No. Young	Average Size
Black duck	15	68	4.5
Mallard	4	14	3.5
Blue-winged teal	1	8	8.0
Wood duck	6	29	4.8
Ringneck	11	50	4.5
Redhead	2	4	2.0
Golden-eye	2	5	2.5
Hooded merganser	5	36	7.2

The black duck is the most common breeding duck of the district. On the basis of territorial pairs, blue-winged teals were rated second. Wood ducks nest both in the Pre-Cambrian and limestone formations, and were rated third. Mallards, restricted to the limestones, rated fourth. The hooded merganser was found only on the Shield and there was believed to be more common than the figures would indicate. Golden-eyes are scarce throughout; ringnecks were restricted to Conroy Marsh, and redheads were seen only on Hay Bay of Lake Ontario.

A report by A. T. Cringan gives waterfowl breeding information obtained incidental to a muskrat survey in the Sioux Lookout District (Latitude 52° 50' Longitude 91° 55'). Five Lakes, Petownikip, Sakwaso, Nikip, Magiss and Senia, were in the study area. Two environmental factors of special note were recorded: (1) the late break-up on June 2 (2-3 weeks behind schedule); (2) the persistence of high water throughout the summer.

Mallards were the most common of the ducks seen. They were well distributed about the lakes and along the streams. Three nests were found and in late August a brood was seen repeatedly with the young still unable to fly by September 1. Green-winged teal were generally distributed throughout the study area, and two broods were seen. Pintails were seen principally on the Petownikip Marsh in late June. Black ducks were noted only twice, blue-wings once, and baldpates a few times in June. Scaup were observed sparingly through the area mostly in June. Golden-eye drakes were common in June, and early July, but hens were not common. One brood was noted. Both American and red-breasted mergansers were seen regularly and one nest was found.

Banding

At least one thousand ducks were banded from mid-summer to October 1. Mr. C. O. Bartlett banded 852 ducks (507 blacks, 255 pintails, 68 mallards, 13 hybrid mallard-black, and 9 teal) at Moosonee and Cochrane, while L. W. Gray banded 118 ducks through September 15 with traps expected to remain in operation until October 7 in the Fort Francis area.

WATERFOWL SURVEY IN NORTH-WESTERN ONTARIO - 1950

Lester W. Gray

Introduction

The primary objective of this survey by the Department of Lands and Forests, was to locate a suitable area to set up a banding station. No attempt was made to run a complete census, or to take representative samples, and the survey was made by one man working alone. Two regions were picked, and the water within these areas intensively studied to locate breeding concentrations. It was felt that the places used by comparatively large numbers of breeding birds would also be used by the fall flights, as good waterfowl habitat in this part of the Province is limited.

Location of Areas

The areas covered by the study were the district of Thunder Bay, and the district of Rainy River.

Ten water areas were examined in the Thunder Bay district, from Cranberry Bay on Lake Superior at the eastern extreme to Whitefish Lake on the west. About 200 miles of aerial reconnaissance was also flown. Of all areas examined, only Whitefish Lake was found to be favourable waterfowl habitat, and this was the only place where breeding birds were found in numbers. Most of the lakes were barren of marsh, and rimmed by rocky or wooded shore-line. It was thought unwise to attempt banding on Whitefish, as it was a favourite shooting spot for gunners from Port Arthur and Fort William. In fact, the only place for many miles where duck shooting could be done.

In the district of Rainy River two areas were examined. One consisting of part of the shore line of Caliper Lake and its tributary, Log River, and the other a series of artificial ponds on the private game reserve of Mr. J. A. Mathieu. The former area lies on the Kenora -- Fort Frances highway, about four miles south of Nestor Falls. The latter, on the Rainy River, about twelve miles west of Fort Frances.

The better areas were checked, either by shore-line cruising in a canoe, or by walking. Reconnaissance work was done by jeep and aircraft.

Weather and Water Conditions

The spring and early summer were cold and wet, and rivers and lakes were badly flooded. Rainy River was well above normal as late as the middle of July. Conditions were thus far from ideal for breeding waterfowl.

Predation by northern pike on diving duck broods in Whitefish Lake is thought to be extremely high. Blacks and mallards appear to fare better, due to the fact that they remain in the thick, weedy cover along the shore and seldom venture out on the open water where the other species were commonly found. They were thus relatively inaccessible to the predatory fish.

The Caliper Lake area was cruised only once, so little information was obtained regarding brood survival.

On the J. A. Mathieu section, brood survival appeared to be excellent. No large fish were present in these waters.

Area	Species	CLASS 1 No. Broods	CLASS 1 Ducklings Per Broods	CLASS 11 No. Broods	CLASS 11 Ducklings Per Broods	CLASS 111 No. Broods	CLASS 111 Ducklings Per Broods
Whitefish Lake	Mallard	2	8.0	-	-	-	-
	Blacks	2	9.5	-	-	-	-
	Ring-neck	1	8,0 *	-	-	-	-
	A. golden-eye	1	9.0 *	-	-	-	-
	Unidentified	2	8.0	-	-	-	-
Caliper Lake	A. golden-eye	2	4.5	-	-	-	-
Log River	B-w. teal	1	9.0	-	-	-	-
	Unidentified	2	6.0	-	-	-	-
J. A. Mathieu	Mallard	2	4.5	3	5.7	2	5.0
Reserve	B-w. teal	9	6.8	7	6.0	4	6.2
	Unidentified	1	10.0	3	4.3	1	6.0

* Ring-neck brood reduced to 6 by Pike while under observation. Golden-eye brood of 9 had only 2 when re-visited the same day. One of the remaining 2 taken by Pike while under observation.

Species Composition of the Breeding Population

Area	Species	Total Population	Percent
Whitefish Lake	Blacks	78	41
	Mallard	62	33
	Lesser scaup	41	22
	A. golden-eye	3	2
	Ringneck	2	1
	B-w. teal	2	1
Caliper Lake - Log River	A. golden-eye	23	62
	Lesser scaup	11	30
	Ringneck	1	2
	Canvasback	1	2
	Mallard	1	2
	B-w. teal	1	2
J. A. Mathieu * Reserve	Mallard	17	47
	B-w. teal	15	42
	Pintail	4	11

* Most of the birds tallied on this area were females with broods.

Banding Operations

Traps were operated on the Mathieu Reserve from August 22 until October 7. The following birds were banded: mallard - 193, blacks - 14, blue-winged teal - 4, green-winged teal - 9, pintail - 1, baldpate - 1, pied-billed grebe - 1.

Conclusions

Although this part of the Province is not considered a good duck producer at best, it is felt that this year was below average. It is also felt that the extremely wet weather and large amount of water available had an adverse effect on trapping, by allowing the birds to scatter over a wider area. Thus the density of birds in the trapping area was less than normal.

WATERFOWL OBSERVATIONS IN THE COCHRANE DISTRICT OF NORTHERN ONTARIO

1950

Charles O. Bartlett

Introduction

This report covers a survey of waterfowl breeding grounds in the Abitibi Lake and Nighthawk Lake areas of northern Ontario made in connection with a duck banding project near Moosonee. The survey began on June 8 and ended on July 11, 1950. An attempt was made to do a brood census of waterfowl in the Abitibi Lake area, and data were collected on the breeding population and relative abundance of each species, chronology of the nesting season, and the types of waterfowl habitat encountered in the survey.

Supplementary data on duck banding operations carried on near Moosonee, Ontario, from July 15 to September 1, are also included in this report.

Methods and Procedures

Commencing June 8 a survey was made of Abitibi Lake (that portion lying in the Province of Ontario) and Nighthawk Lake, both in the Cochrane district. Some 182 miles of shoreline of these two lakes were cruised with a canoe and outboard motor. Abitibi Lake was found to have the greatest number of ducks and was selected as the most likely area from which information on the breeding population and broods could be obtained. Relatively few ducks were seen in the Nighthawk Lake area and the findings presented in this report are confined to the Lake Abitibi area. In the period from June 11 to July 11, 93 miles of shoreline on Abitibi Lake were cruised 3 times, each cruise taking from 3 or 4 days to complete. A lake-going boat was used to traverse the lakes, a canoe and outboard motor were used in the actual shoreline cruising. In the bay the cruise line followed as close to the emergent vegetation as was possible, the distance varying somewhat depending on the depth of the water. When the bays were sufficiently narrow to make observation on both sides the ducks on the two shorelines were counted at the same time. The same procedure was followed on the rivers. The duck count was taken on the rivers proceeding upstream from the lake and ended where the rivers were no longer navigable with a canoe and outboard motor. The 93 miles of shoreline can be distributed as follows:

1. Ghost River, including McCool Creek (20 miles) and Garrison Creek (2 1/2 miles) . . . . . 57 miles

2. Swampy Creek and O'Brien Bay . . . . . 13 miles

3. Lightning River and Lightning Bay . . . . . 23 miles

(Distances were measured on the Abitibi Sheet, National Topographic Series, which has a scale of 1 inch equal to 2 miles.) The number of ducks per lineal mile of shoreline was computed for each complete coverage. Brood data were gathered on the second and third coverages in the period from June 28 to July 11.

Types of Waterfowl Habitat

The shallow bays of Abitibi Lake and three of the rivers draining into them contained the greatest number of nesting ducks. The remainder of the shoreline is rocky and heavily forested with dense stands of spruce, balsam poplar, and white birch.

The nesting areas were scattered and accessible from the lake only. The 93 miles of shoreline cruised in the survey were located at (1) Swampy Creek emptying into O'Brien Bay on the north side of Abitibi Lake, (2) Lightning River emptying into Lightning Bay on the south side of the lake, and (3) Ghost River also on the south side of Abitibi Lake. Lightning River with its dense young growth of balsam poplar, white birch and willow (following a burn in 1928) provided abundant shore vegetation. Ghost River provided the best nesting habitat for the American golden-eye and most of the broods of this species were observed in this area.

The characteristic vegetation consisted of cattail (Typha latifolia) sedges (Carex spp.), bulrushes (Scirpus spp.), pondweed (Potamogeton spp.) coontail (Ceratophyllum spp.), horsetail (Equisetum spp.), reed grass (Phragmites spp.) and yellow pond lily (Nuphar spp.). Cattail was by far the more abundant and extended 500 yards from the shoreline in several places.

Summarizing, the types encountered on Abitibi Lake can be classified as follows:

A. Shore vegetation:

(1) Mature timber with occasional cavities for American golden-eyes - Ghost River and O'Brien Bay.

(2) Immature timbers with no cavities - Lightning River.

B. Emergent vegetation:

(1) Stands of cattail, bulrush, and sedge found in shallow bays and rivers - includes the three nesting areas mentioned above.

(2) Rocky shores with no emergent aquatics - includes the remainder of the shoreline.

Chronology of the Nesting Season

Conditions prior to June 10.

Trappers Eugene Tremblay and Tavio Salo volunteered the following information on the nesting season prior to my arrival.

The nesting period was delayed from two to three weeks in the areas visited in the survey. Ducks and geese were observed on Abitibi Lake two weeks prior to the break-up and removal of the ice on May 23, as compared to May 2, in 1949.

Conditions after June 10.

Nesting on Abitibi Lake had been underway two weeks by June 10. Some American golden-eyes were nesting on May 27, four days after the departure of the ice and blacks were known to be nesting in the area on June 4 (dates estimated from the broods observed on the area). The first brood of American golden-eyes was observed by Tremblay on Abitibi Lake on June 17; the first young blacks that I saw were hatched on June 30 and left the nest on July 1.

No flightless birds were seen on the area.

Table 1. — Species Composition of the Breeding Population on Abitibi Lake

Species	June 11-15 No. of Adult Birds	June 11-15 Percent of Population	June 28-July 1 No. of Adult Birds	June 28-July 1 Percent of Population	July 7-11 No. of Adult Birds	July 7-11 Percent of Population	Ave. no. of Adult Birds Seen for Total Period June 11 to July 11	Percent of Population
American golden-eye	102	33	124	53	133	51	120	45
Ringneck duck	65	21	67	29	93	35	75	28
Black duck	114	37	30	13	28	11	57	21
Blue-winged teal	19	6	7	3	2	1	9	3
Mallard	9	3	4	2	5	2	6	3
Total	309	100	232	100	261	100	267	100
Total ducks per lineal mile of shoreline	3.3		2.5		2.7		2.9	

Water and Weather Conditions

Water levels in the area were very high during the month of June with recorded rainfall of 5.7 inches and rain on 24 days of that month (data obtained from Harry Walsh, fire ranger at the Lightning Bay Forestry Station, Department of Land and Forests). Temperatures were generally low, snow and hail was recorded on June 10 and frosts on the nights of June 17 and 18. Water levels dropped around the middle of July, and relatively warm weather occurred throughout the latter part of July and the month of August.

Relative Abundance of each Species

Observations on the breeding population of Abitibi Lake are summarized in Table 1. Other species observed on the area in the early stages of the survey were green-winged teal (1), and baldpate (2). These two species were not observed on later surveys and are not included in the breeding population.

Brood Census

A brood census was attempted in the Lake Abitibi area. Brood observations on the 93 miles of shoreline were made on the dates shown in Table 2. There was not sufficient time to observe broods of all species nesting on the area as only American golden-eye broods were seen, and these were in the Class 1 or downy stage. Black ducks would probably not be on the open water until late in August. Wright (Trans. 13th N. Amer. Wildlife Conf., p. 357) found in New Brunswick that black ducks were usually growing their first feathers when they appeared on the open water. Some ring-necked ducks were still incubating on July 11.

The number of broods per mile of shoreline and the number of ducklings per brood of the American golden-eye are given in Table 2.

Table 2.

June 28 to July 1		
No. of Broods	No. of Broods per Mile of Shoreline	No. of Ducklings per Brood
17	.18	8.6

July 7 to July 11		
No. of Broods	No. of Broods per Mile of Shoreline	No. of Ducklings per Brood
20	.22	6.9

Banding

On July 21 a duck-band station was set up on the west coast of James Bay, 24 miles from the mouth of the Moose River and 36 miles from Moosonee. The location is approximately 51 degrees, 41 minutes North Latitude and 80 degrees, 35 minutes West Longitude. The banding area comprises roughly some 3,000 acres of marsh located between Big Piskwanish Point and Piskwanish Point. The marsh is interrupted by a series of sand ridges (former beaches) that run parallel with the coast-line. The

numerous ponds and sloughs are located between the ridges, the largest not exceeding five acres in size. None of these ponds are accessible by canoe from the coast-line.

Two species are known to nest in the banding area. A green-winged teal brood of six was observed on July 22 and a mallard brood of seven was observed on July 23. The same or another mallard brood was observed on August 28, the young with the primary feathers still undeveloped.

Predation on ducks in the cages accounted for 1.5 percent of the total number of birds trapped. Predators included goshawk, duck hawk, great horned owl, marsh hawk, and red fox.

Ten recoveries (birds banded outside the area) were obtained on the banding area. The species with these band numbers and dates trapped are given below.

	Species Recovered	Band Number	Date Trapped
1.	Black duck	47-715791	8/13/50
2.	" "	507-78545	8/17/50
3.	" "	47-719619	8/18/50
4.	" "	497-20660	8/19/50
5.	" "	507-20029	8/19/50
6.	" "	41-741659	8/21/50
7.	" "	497-04230	8/23/50
8.	Mallard	507-01686	8/27/50
9.	Black duck	42-616069	8/29/50
10.	" "	34-609383	8/30/50

Discussion

The index obtained for the breeding population in the Lake Abitibi area should be useful for comparison with any future surveys made in the same area. It should be emphasized that this area is choice waterfowl habitat and as such provides trend information only. It does not necessarily indicate the over-all picture for the Cochrane district.

The inaccessibility and the location of a great number of lakes in the northern part of this district do not permit the use of ground transect methods in evaluating waterfowl populations. In the southern parts of the district good highways will permit the use of the car transect method and ground transects on foot. No one method would be practical in evaluating waterfowl populations for this entire district. In parts of Manitoba and other parts of Canada where similar conditions exist, aerial census of these remote areas combined with ground census of the more accessible areas have met with considerable success. An aerial census of this northern area would, I believe, also be a preliminary step to determine what part these more remote areas play in the waterfowl production for the district and for the Province as a whole.

The high water-levels maintained during the month of June should be considered when evaluating the index obtained in this survey. Had water-levels remained low an entirely different index might have resulted. Any repetition of such high water-levels during the incubation stage of a nesting season might be a serious factor affecting the productivity of the area.

The brood survey was disappointing as the time allowed was not sufficient to obtain enough data on the various species nesting in the study area. Hochbaum (The Canvasback on a Prairie Marsh, 1944, p. 160) says: "There is no confined period during the spring or summer when all broods of all species may be seen..... A

reliable study of summer populations can be made only when the same area is covered at frequent intervals throughout the course of a season." An early arrival at James Bay was considered necessary to locate a banding station and work on the brood census which ended on July 11. At the time it was thought that the brood data might be supplemented with data on broods from the banding area, but only two broods were observed after July 11.

The number of golden-eye broods observed was too small to draw any conclusions regarding brood survival for this species.

Of the sex ratios obtained in banding for various species and age groups, only those encountered among adult black ducks (high preponderance of males) and among adult pintails (high preponderance of females) differ significantly from a theoretically even ratio. It is occasionally possible for a banding station to favour one sex against the other in trapping samples of a waterfowl population, but it is not known whether or not this bias appears in my operations. It is, however, unlikely that this bias would shift importantly from one species to another.

Summary

A survey of waterfowl breeding grounds in the Lake Abitibi area of northern Ontario was made in connection with banding operations at Moosonee. An index of population abundance was obtained for waterfowl nesting in the area and the relative abundance of each species was determined.

A brood census was attempted on the same area. The time involved was too short to observe broods of all species.

Eight hundred and fifty-two ducks were banded near Moosonee from July 25 to September 1.

Combination of aerial and ground censuses are suggested as a means of evaluating waterfowl populations for the district; aerial censuses in the northern inaccessible areas and ground transects in the southern part of the district where good highways are available.

WATERFOWL BREEDING GROUND SURVEY IN QUEBEC AND EASTERN ONTARIO-1950

John S. Tener

Introduction

The 1950 waterfowl breeding ground survey in Quebec and Eastern Ontario was divided into two phases. A preliminary study of waterfowl productivity on precambrian lakes in eastern Ontario was initiated during June by F. G. Cooch, under the writer's direction. In Quebec in the key study areas established last year a census was taken of breeding waterfowl in May by the writer and Mr. Cooch, and the areas were revisited by Mr. Cooch in July to obtain brood counts.

Survey Methods and Study Areas

The information obtained in the preliminary study of the precambrian lakes in Ontario will be useful for future projects. Data were secured on 56 lakes in the area bounded on the south by Number 7 Highway from Maberly to Havelock, on the west by Highway 62 from Havelock to Barry's Bay, on the north by Highway 60 from Barry's Bay to Eganville, and on the east by a line from Eganville to Maberly, - an area of approximately 2800 square miles. At each lake data were obtained on pH, aquatic and terrestrial vegetation, lake bottom type, nesting and escape cover, degree of human activity, waterfowl and loon population present, and other pertinent factors. An automobile and a motor-driven canoe were used for transportation.

A census was taken again this year in key areas established in Quebec for breeding waterfowl census purposes last year. They were Clement Bay, Lochaber Bay and Black Bay on the Ottawa River, the Carillon Island Bird Sanctuary near St. Andrew's East, the South River Bird Sanctuary, near Henryville, Lake St. Peter, the Island of Orleans and Cape Tourmente near Quebec City, and the south shore of the St. Lawrence River from Levis to St. Flavie. The sample areas were covered by canoe and on foot.

Climatic Conditions

Spring in Ontario and Quebec appeared to be two to three weeks later than normal, delaying somewhat the main waterfowl migrations. Large flocks of some species of waterfowl that had not yet dispersed to establish nesting territories were found. Temperatures were above normal in May but June and July were cold and wet. No adverse effects on nesting and production were apparent.

Discussion of Data Obtained

It is emphasized that the investigation of the relationships of precambrian lakes to waterfowl production is only preliminary, but certain generalizations have been formed. The pH value of a lake does not, in itself, determine occupancy by waterfowl, but by governing the composition and density of aquatic plant and animal populations, it indirectly influences the nature of the habitat present, which may or may not, because of biotic or environmental factors, be acceptable to waterfowl.

Most of the lakes examined were found to be barren of waterfowl, or practically so, with only six classified as good areas. It would appear that much of the waterfowl production in the region examined is the result of large marginal areas, or lakes on limestone, producing scattered broods of ducks that form a significant total, rather than of any one area being unusually productive.

Quebec

Figures obtained in Quebec in May of this year cannot be directly compared with those of 1949, because of the earlier census date in 1950 and because many, if not the majority, of ducks seen would be nesting further north. The Ottawa River and Lake St. Peter serve as food barriers to migrating waterfowl. On the Ottawa River concentrations of Canada geese, ring-necked ducks, and lesser scaup were observed, most of which had migrated further north by the time the July count was made. On Lake St. Peter large concentrations of black ducks and pintails were present, as well as smaller flocks of blue-winged teal and lesser scaup.

Canada geese, brant, and American eiders were on the south shore of the St. Lawrence River from Montmagny to St. Flavie.

The brood survey undertaken during the period July 6 to 16 showed an increase, in comparison with that of 1949, in pond duck and eider populations, with a slight decrease in numbers of diving ducks. Black ducks and blue-winged teal, in particular, increased in numbers. Broods of blue-winged teal, black ducks, and wood ducks were in that order of size.

The July survey also indicated an expected change in percentage composition of species of waterfowl in the various study areas. The geese, except for two pairs nesting in Lochaber Bay, lesser and greater scaup on the Ottawa River and St. Lawrence River, and the majority of black and pintail observed on the marshes of Lake St. Peter, had left the areas, presumably for more northerly breeding grounds.

Wood duck populations increased measurably over the May census figures in those marshes where the birds occur. The late spring probably delayed their migration.

In summary, the cold, wet months of June and July did not appear to affect the production of young waterfowl in Quebec. An increase was noted in numbers of pond ducks and eiders, with a slight decrease in numbers of other diving ducks.

Table 1. — Waterfowl Breeding Population Study - Quebec, 1950

Species	Clement Bay M	F	Pr.	?	Total	Lochaber Bay M	F	Pr.	?	Total	Black Bay M	F	Pr.	?	Total
Canada goose				2	2				3	3			26		52
Baldpate								2		4			1		2
Black			7	42	56			14	3	31			5	1	11
Mallard								2		4					
Pintail	1		9		19	4				4					
G-w. teal								2	11	15			3		6
B-w. teal								2		4					
Wood duck								1		2			2		4
Lesser scaup	10	5		10	25			3	63	69					
Greater scaup								9		18					
Ring-necked						23	11	1		36					
Bufflehead						1		3		7					
Am. golden-eye															
Total	11	5	16	54	102	28	11	39	80	197			37		75

Species	Ottawa River at Montabello M	F	Pr.	?	Total	Carillon Isl. & Carillon Bay M	F	Pr.	?	Total	South River Bird Sanctuary M	F	Pr.	?	Total
Canada goose									11	11					
Baldpate								1		2					
Black								12	20	44			4	11	19
Mallard								1		2	4				4
Pintail								1		2	7				7
G-w. teal								3	19	25					
B-w. teal						2		5		12			5	1	11
Wood duck													2		4
Lesser scaup	43		66		175	420	278	18	48	782			1		2
Greater scaup															
Ring-necked			1		2										
Bufflehead								3	2	8					
Am. golden-eye	1				1	3		1		5					
Total	44		67		178	425	278	45	100	893	11		12	12	47

Table 1. (Continued)

Species	Lake St. Peter M	F	Pr.	?	Total	Cape Tourmente M	F	?	Total	Montmagny to Riviere du Loup M	F	Pr.	?	Total	Riviere du Loup to St. Flavie M	F	Pr.	?	Total	Grand Total
Canada goose				60	60								529	529						657
G. snow goose									20,000				6	6						20,006 (est.)
Brant				72	72								245	245				1,604	1,604	1,921
Baldpate																				8
Black			60	1172	1292							12	56	80			9	87	105	1,638
Mallard	3	1	3		10															20
Pintail	45	5	123	1458	1754															1,786
Shoveler	3		2		7															7
G-w. teal	8	2	45	79	179					3		1		5						230
B-w. teal	15	1	108	61	293															320
Wood duck			4		8															18
Lesser scaup			17	216	250										1	2			3	1,306
Greater scaup																				18
Ring-necked																				38
Bufflehead	1		1		3															18
Am. golden-eye	4	2	11		28															34
Am. eider										14	3	11		39	1015	696	125	489	2,450	2,489
Total	79	11	374	3,118	3,956				20,000	17	3	24	836	904	1,016	693	134	2,180	4,162	30,514

Table 2. — Waterfowl Breeding Population Study, Quebec, Brood Counts - July, 1950

Area	Black duck			Blue-winged teal			Wood duck		
	No. of Broods	No. of Juveniles	Av. Brood Size	No. of Broods	No. of Juveniles	Av. Brood Size	No. of Broods	No. of Juveniles	Av. Brood Size
Lochaber Bay	6	36	6	4	29	7.2	4	23	5.7
Black Bay	1	5	5						
Clement Bay	1	6	6				2	9	4.5
Carillon Bay	2	10	5	1	8	8			
Carillon Island	4	18	4.5	1	5	5	3	12	4.0
South River	4	16	4.0	2	9	4.5	1	5	5
Lake St. Pierre	10	67	6.7	16	99	6.2	3	13	4.3
Total	28	158	5.6	24	150	6.2	13	62	4.8

Area	Am. golden-eye			Ring-necked duck			Canada goose		
	No. of Broods	No. of Juveniles	Av. Brood Size	No. of Broods	No. of Juveniles	Av. Brood Size	No. of Broods	No. of Juveniles	Av. Brood Size
Lochaber Bay				3	18	6	1	2	2
Black Bay									
Clement Bay									
Carillon Bay									
Carillon Island									
South River				1	5	5			
Lake St. Pierre	3	31	10.3						
Total	3	31	10.3	4	23	5.7	1	2	2

Table 2. — Waterfowl Breeding Population Study, Quebec, Brood Counts - July, 1950 (Continued)

American Eider	St. Anne de la Pocatiere		Kamouraska		St. Germaine		Andreville		N.D. du Portage		Riviere du Loup		Ile Verte	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
Juveniles		16	14	11	63	103	71	90	3	5	32	30		210
Adult Males														
Adult Females	8	11	18	21	184	211	110	95	9	8	24	18	200	180

American Eider	Bic		Rimouski		Point Au pere to St. Luce	St. Luce to St. Flavie	Total to Rimouski		1950 Grand Total
	1949	1950	1949	1950	1950	1950	1949	1950	
Juveniles	174	96	329	400	520	118	686	959	1,597
Adult Males			73	85	125	55	73	85	265
Adult Females	95	35	314	360	411	80	962	940	1,431

WATERFOWL BREEDING GROUND SURVEYS IN EASTERN CANADA, 1950

C. E. Addy, L. D. Cool, G. F. Boyer, H. R. Webster, and R. Mosher

Introduction

This is the second year of a program of intensive surveys of waterfowl breeding grounds in eastern Canada. Many of the breeding areas which were surveyed last year were covered, and in addition new habitat was investigated.

Limited ground surveys were conducted in the spring by G. F. Boyer, Harry Webster, Ralph Mosher of the Canadian Wildlife Service, and C. E. Addy of the U. S. Fish and Wildlife Service. Aerial surveys over the same census routes as followed last year were again conducted by U. S. Game Management Agent and Pilot Leon D. Cool and observer Addy with a Fish and Wildlife Service Fairchild plane. In the aerial survey many of the overland transect runs made last year were eliminated this year, and delays prevented the coverage of any of the St. Lawrence River habitat from Mingan west to Lake St. Peter and Lake St. John. Unfortunately, much of the data obtained from the aerial flights made are not comparable to those of last year due to the fact that many areas were covered three to four weeks later than in 1949. The flights in southern New Brunswick and Nova Scotia began May 28 and ended June 9. It was not until June 23 that aerial surveys were resumed on Prince Edward Island, and the last run on Anticosti Island was made on July 2.

During the period July 5 to 27 Cool and Addy conducted aerial surveys of the extensive marshes at the head of the Eagle and St. Lewis rivers in southeastern Labrador and the shoreline and marshes of Lake Melville and the Hamilton River Inlet east of Goose Bay.

From early May until the last of July, Ralph Mosher, Student Assistant, conducted observations on flocks of adult black ducks in order to determine their breeding status. Although early observations were made on Prince Edward Island in conjunction with a crow-waterfowl study, the period June 14 to July 31 was spent in concentrated study of flocks of blacks in the Grand Pré vicinity of Nova Scotia.

Methods and Areas Covered

In eastern Canada limited spring ground counts were made by canoe and on foot of the same areas as covered in 1949 in New Brunswick, Nova Scotia, and Prince Edward Island. However, the greater part of the breeding ground coverage was by plane. As mentioned previously, certain transect and other flights were eliminated this year. New areas were investigated in northern New Brunswick, Nova Scotia, western Prince Edward Island, the interior of Anticosti, and southeastern Labrador. The routes traveled both this year and last are shown in Figure 1.

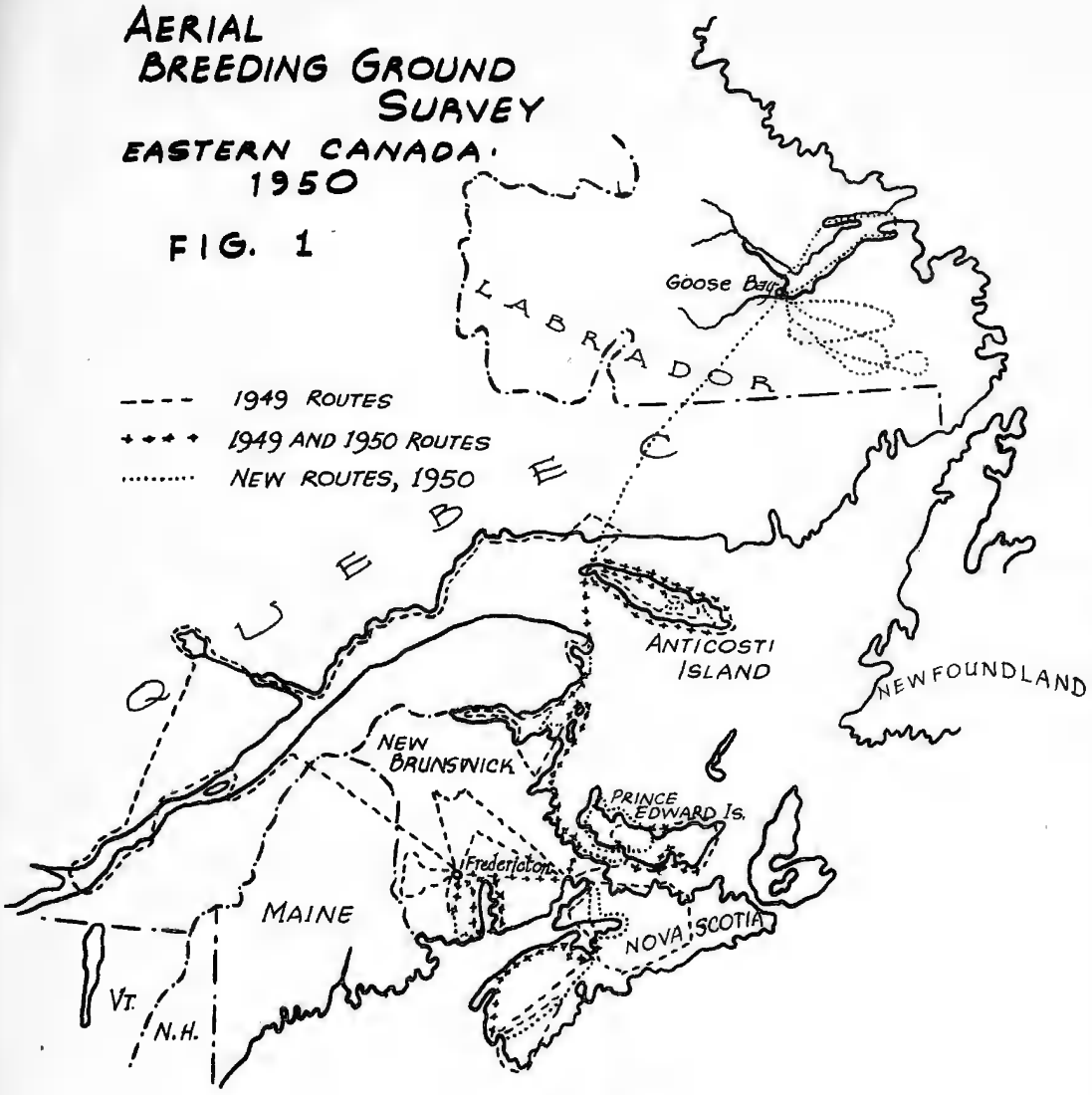
Weather and Water Conditions

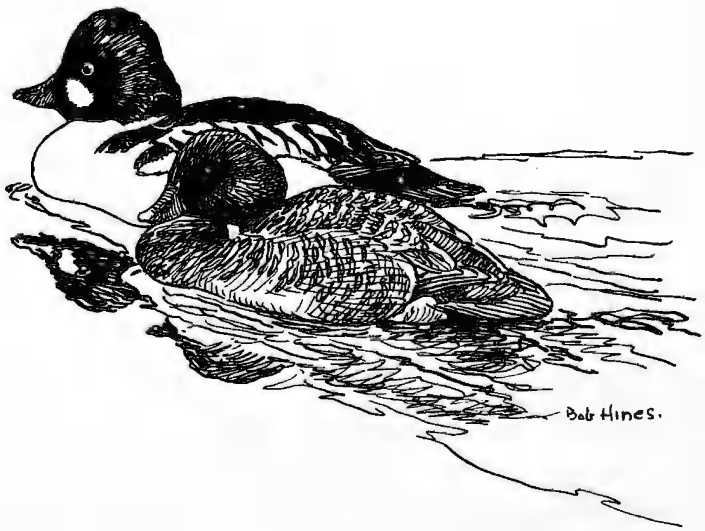
Throughout most of eastern Quebec and the Maritimes, March temperatures ranged from one to five degrees below normal. For the remainder of the breeding season temperatures followed closer to the normal although there were many local excesses and deficiencies. In general, temperatures during July and August averaged a few degrees below normal.

Precipitation throughout eastern Canada during March was quite variable with excesses occurring generally in interior portions and deficiencies in coastal regions. During April, however, the southern coastal areas received excesses while much of

AERIAL BREEDING GROUND SURVEY EASTERN CANADA 1950

FIG. 1





Blank Page Digitally Inserted

the northern coastal region (Anticosti and the north shore of the gulf) reported deficiencies. In general, May was a very dry month throughout the region. June, however, was a wet month, with considerable excess rain reported from many areas. Precipitation in July was very scattered, while rainfall during August was generally above normal in the Maritimes.

The cool spring apparently retarded breeding activities as much as ten days to two weeks. This delay coincided more or less with a rise in water levels so that there was very likely an insignificant loss of nests. Although Prince Edward Island and parts of Nova Scotia experienced deficiencies in rainfall this was not generally the situation in western and central New Brunswick. Although water levels in the St. John River receded from the initial spring level, subsequent precipitation kept the late spring and early summer levels high.

Breeding Population Trends

In late April and May some 12 marsh areas on Prince Edward Island, the New Brunswick - Nova Scotia border region and the lower Hampton marsh were surveyed again this year by canoe and on foot. In addition, six new areas on Prince Edward Island and four in Nova Scotia were surveyed.

Since a determination of the status for any one area would be undesirable the percent increase or decrease for all areas combined are given as follows:

Total all ducks	— 14%
Black duck	— 13%
Pintail	— 14%
Ringneck	— 33%
G-w. teal	— 12%
B-w. teal	+ 30%

Table 1, in a similar manner, gives the percent increase or decrease as found by aerial surveys in eastern Canada. The table is totaled in two parts because of the differences in dates of coverage as compared with last year for the same areas. The counts made in southern New Brunswick and Nova Scotia were made on dates more comparable to those of last year. The remainder of the surveys ending with Anticosti Island were made three to four weeks later this year, so that the data are very likely not comparable. The extreme reduction in counts on the later surveys compared with last year indicates that the lateness of this year's survey probably influenced the data to some extent.

In the first group, where the surveys were comparable to those of 1949, the data show the black duck population to be about the same as last year in the Maritimes, and for all species a slight increase. Combining all the surveys in eastern Canada we find a 33 percent reduction in blacks and a 24 percent reduction in all species. It is believed, however, that the results of the earlier surveys are more indicative of the actual status of the population. Blanks under the species columns indicate less than 50 birds, or too few to warrant a percentage determination. Actually, the black duck is the only species that occurs in sufficient numbers on the routes flown to show trends adequately by aerial surveys.

Summary of Breeding Ground Surveys

Although a marked reduction in the over-all population is indicated from a summary of all surveys, it is believed that the results of the surveys in the New Brunswick and Nova Scotia areas are a more reliable index. The latter are more comparable to similar surveys in 1949.

These data show little change in the black duck population from that of last year. The ringneck and golden-eye continued to show an increase although the former apparently is still below the 1945 level as reported by the Northeastern Wildlife Station. Other species occur in such small numbers that trends are difficult to determine. However, there is every reason to believe that the pintail, blue-winged teal and green-winged teal are at least holding their own.

Extensive brood surveys by canoe and on foot were conducted in 1949. No similar endeavor was made this year so that comparable data are not available for determining a trend in production. Mosher conducted brood surveys in the Grand Pré-Canard area, the Kentville Sanctuary, and the Annapolis River marshes in Nova Scotia. These same areas were covered in 1949. Due to the fact that Mosher spent considerably more time in the studies and covered more of the Grand Pré area, the data are not exactly comparable to these of 1949. However, Mosher recorded a total of 15 black duck, 1 green-winged teal, and 6 blue-winged teal broods. For the same area 7 black duck, 8 blue-winged teal and 2 green-winged teal broods were recorded in 1949. The actual increase is undoubtedly not as great as shown, but the data are indicative of a good or a better production this year.

Reconnaissance Survey on Anticosti Island and in Southeastern Labrador

Anticosti

Several days were spent in late June and early July in the interior of Anticosti examining the Lake Wichenden area on foot and flying low over most of the marshes in the eastern inland part of the island and along the south shore. The purpose of this reconnaissance was to determine the extent of black duck and Canada goose breeding. The results were disappointing to say the least. Although weather prevented flying more than 25 percent of the time, much of the important marsh area on the island was covered. During the whole stay on the island only 3 broods of blacks and 4 broods of Canada geese were tallied. In addition, 175 adult geese were seen. Practically all the adult black ducks seen were located on coastal marshes. Several small groups of geese were found on interior lakes and marshes and nearly all or most geese observed appeared to be in a moulting or flightless condition. Anticosti is apparently not an important goose breeding area. With the black duck, the importance of the island as a breeding area remains uncertain and more study will be required.

Southeastern Labrador

The extensive marshes south of the Mealy Mountains in Southeastern Labrador have long been of interest and it was thought that these fresh water areas might produce important breeding populations of black ducks and Canada geese. No one in the past, however, had examined these marshes from the standpoint of waterfowl production and it was for this purpose that the reconnaissance was made.

Operating out of the American airbase at Goose Bay, three separate flights were made over these marshes (see Figure 1) and several landings were made in order to look over part of the terrain on foot. The marshes are quite extensive, being several thousand square miles in area, and drain to the northeast and east principally through the Eagle, Paradise, and St. Lewis rivers.

The habitat is considerably broken up with numerous shallow, dark-watered lakes, ponds, and streams interspersed with extensive open muskegs and dense wooded areas. The waters tested were acid in reaction and contain little or no

Table 1. -- Percent Increase or Decrease in Spring Breeding Population in Eastern Canada, 1950

Region	Black	Wood	G-w. teal	B-w. teal	Pintail	Golden-eye	Ringneck	All Ducks	Canada Geese
St. John River and adjacent areas, N. B.	-15	-	-	-	-	+113	+169	+10	-
N. B. - N. S. Border marshes and Nova Scotia Lakes and marshes	+15	-	-	-	-	-	-	+10	-
Total	- 1%	-	-	-	-	+114	+121	+10	-
Prince Edward Island	-54	-	-	-	-	- 57	-	-53	-
North Shore, New Brunswick	- 7	-	-	-	-	- 44	-	-20	-
Anticosti Island	-80	-	-	-	-	- 20	-	-68	-37
Total	-66	-	-	-	-	- 32	-	-56	-36
Total - All Areas	-33	-	+60	+61	+57	- 12	+118	-24	-35

vegetation. The principal aquatic is Nuphar and only in rare instances were other plants observed.

The size of the waterfowl population was a disappointment. Many hundreds of acres were covered in which few, if any, ducks or geese were observed. Broods were notably scarce and the few encountered were found principally in small backwater areas.

Black ducks and geese were concentrated in a relatively few areas and these were usually large, shallow lakes. Nearly all of the birds encountered were flightless with the individual birds varying as to the extent of feather replacement. Apparently, these extensive marshes are used primarily as moulting areas and are not important for breeding. However, judgment on this point should be reserved until the marshes can be checked another year at an earlier date. It is possible that brood survival may be very low due to a population of the voracious great northern pike which abounds in these waters.

Following are the numbers of waterfowl recorded: Blacks 623, and 5 broods; Canada geese 48, and 3 broods; golden-eye 55, and 4 broods. Red-breasted mergansers were occasional and about 100 adult American and surf scoters were observed.

Although a discussion of the status of the caribou in the area is foreign to a waterfowl report, a short note may be of interest to the reader. Caribou trails were abundant throughout these marshes and apparently the population is scattered widely at this season of the year. Four adults were seen and the tracks of a cow and calf were noted on the sandy shore of one of the lakes. To the north of the Mealy Mountains in the Turner Bight areas of Hamilton River Inlet, two more caribou were spotted. Tracks were abundant here also. About 150 miles southwest of Goose Bay a cow caribou and her calf were seen and trails were abundant in the general area.

A flight was made along the shore of Lake Melville and the western part of the Hamilton River Inlet. Most of the waterfowl observed were in the Hamilton River Inlet area where more extensive tidal marshes occur. A total of 568 blacks, 15 golden-eye, 60 pintail, 24 green-winged teal, 32 Canada geese (with 3 broods), and several thousand surf scoters were tallied.

WATERFOWL BREEDING GROUND SURVEY IN NEWFOUNDLAND, 1950

Leslie M. Tuck

The island of Newfoundland has an area of 42,734 square miles. Its shoreline is rugged and the deep indentations of bays and inlets create a coastline of 6,000 miles in length. The topography in the western section is mountainous, rising to an elevation of 2,673 feet. The interior of the island is undulating, low hills alternating with marshy tracts, and wooded areas interspersed with numerous ponds and rivers. Areas in the higher elevations of the central portion of the island, and areas in the northern portion are alpine tundra. It is estimated that 17,000 square miles of the island are occupied by forest, and 5,000 square miles by ponds and lakes.

Compared with the climate on the nearby mainland, that of the island of Newfoundland is generally more temperate, both in winter and in summer. The annual precipitation varies from 23 inches at St. George's on the west coast, to nearly 54 inches at St. John's on the southeast coast. Summer comes rather suddenly in the month of June and the growth of vegetation is rapid. Fog, created by the meeting of the Gulf Stream with Arctic currents near the Grand Banks, occasionally blankets parts of the coast, but except for ground fog from the larger lakes, which dissipates quickly, the interior is practically free from fog.

Newfoundland, Labrador, has been so scantily studied in relation to this report, that it might be sufficient to state that there is evidence that the interior can support a large number of breeding black ducks and Canada geese, and that parts of the coast line and many suitable islands are breeding areas of the common eider duck.

The purpose of this survey was to obtain a general picture of the breeding potential of sample areas in the Province. No similar project had been attempted previously and therefore no comparative data are available.

Three areas in the island of Newfoundland were visited by the writer during May and June for the purpose of this survey. On the Avalon Peninsula, potential waterfowl breeding areas along 180 linear miles of road were visited. In the Gander area, 486 miles of aerial reconnaissance on three flights were made. Along the Upper Humber, approximately 30 linear miles of waterways were travelled. A two-months familiarization visit to northern Newfoundland and along the Labrador coast presented some opportunities to observe additional waterfowl breeding areas, but prevented follow-up on the breeding success of the areas previously mentioned.

The following species of waterfowl have been recorded as breeding in the Province: Canada geese, black duck, green-winged teal, ring-necked duck, American golden-eye, common eider, American merganser, and red-breasted merganser. Additional species will undoubtedly be added when further studies are made, particularly in Labrador.

Cruise Tally by Regions (pairs)

Species	Avalon (by car)	Gander (by air)	Humber (by canoe)
Canada geese	55	213	3
Black duck	11	5	0
Green-winged teal	19	123	14
Ring-necked duck	0	53	5
American golden-eye	15	93	15

Cruise Tally by Linear Mile (pairs)

Species	Avalon (by car)	Gander (by air)	Humber (by canoe)
Canada geese	.30	.43	.10
Black duck	.06	.01	.00
Green-winged teal	.10	.25	.47
Ring-necked duck	.00	.11	.17
American golden-eye	.08	.19	.50

The known breeding areas of Canada geese along the Humber were not examined and the 3 pairs located were nesting along Main Brook, while flocks up to 34, possibly of non-breeding birds, were encountered around the margins of Birchy Lake. A clutch of six eggs was found on May 14 (Avalon), and the earliest downies were four seen on May 27 (Gander). Several clutches examined on June 6 (Humber) were still in incubation stage.

The black duck is a well-distributed fall migrant on the island and 508 were recorded in the mid-winter survey. Only future studies will determine its breeding status.

The ring-necked duck may be of comparatively recent occurrence. The center of abundance appears to be in the Gander area. The finding of 5 pairs in the Humber area establishes an additional breeding locality.

The writer located 62 nests of eider ducks on the island in Hare Bay, during early July. The average clutch was four eggs, and the earliest downies were observed there on July 9.

There is evidence of predation by arctic foxes stranded on the islands along the Labrador coast in general. Residents informed the writer that, as a consequence, eiders had a greater tendency to nest in suitable locations along the mainland. The writer's observations indicated, however, there was no scarcity of young eiders in August.

Black ducks were observed as far as Davis Inlet (the farthermost point of the writer's trip), where two pairs were observed in early July. An estimated 1,100 black ducks were recorded along a two-mile stretch of coast line (Tinker Harbour) on August 15. A check of one-half mile of gullies in an adjacent area on August 19 revealed four broods of black ducks (totalling 19), 93 adult blacks, 14 green-winged teal and 3 adult pintail. On the same date geese were feeding in small flocks on the islands near-by.

WATERFOWL BREEDING GROUND SURVEY IN THE ST. JOHN ESTUARY, NEW BRUNSWICK - 1950

Brian C. Carter

Introduction

This is the sixth year that the survey has been carried out. The method of sampling has not changed so all results are comparable.

Phenology

As usual, the blacks were the first species to arrive on the study area this year. They arrived on March 31 as compared with March 28, 1949, April 4, 1948, and March 26, 1947. The blacks were followed by the wood duck (April 5), golden-eye (April 7), mallards (April 13), Canada geese (April 14), ring-necked ducks (April 17), green-winged teal (April 25), and blue-winged teal (May 5). By this time black, golden-eye and wood duck nesting was well under way. The first black duck brood was seen on June 5, as compared with May 17, 1949, May 14, 1948, and May 18, 1947. The first flightless blacks were seen on July 7 this year, June 27 in 1949, July 9 in 1948 and June 23 in 1947.

The ice broke up in the St. John River on April 21 this year, which was later than the last three years (April 5, 1949, April 9, 1948, and April 19, 1947).

The flood was quite high but did not stay at its peak as long as usual. The level dropped to about half flood height quickly and very gradually thereafter. All through the brood season the water level was five to six feet higher than the average level for that time of year. These conditions do not seem to have affected the nesting or breeding success of the waterfowl.

Hatching Success and Brood Survival

Table 1 shows the hatching success and brood survival for 1950 and compares this year with the average for the years 1945 to 1950.

Less broods were seen this year (in many cases well below the average) because of the higher water level of the river during the brood season. The primary rearing covers did not dry up until much later than usual this year, and consequently the broods were not forced out into the less dense vegetation of the secondary rearing covers where they could be seen until the water level went down towards the end of the brood season. By this time many of the earlier nesting species were a-wing. Except for the black ducks and the blue-winged teal, most classes of broods were larger than the six year average. There was a slight increase of duckling mortality this year in all species except the ring-neck, which shows a decrease. Brood survival as a whole was a little below the average of previous years with the golden-eye showing the largest decrease.

Table 1. -- Hatching Success and Brood Survival

Species	Before Reaching Water		Class 1		Class 11		Class 111		
	No. Broods	DKLS/ Brood	No. Broods	DKLS/ Brood	No. Broods	DKLS/ Brood	No. Broods	DKLS/ Brood	Remarks
Blacks									
Av. (45-50)	5#	10.0#	20.3	7.9	11.8	5.9	15.8	6.2	# 1 year
1950	-	-	6	5.8	9	5.0	14	4.6	
B-w. teal									
Av. (45-50)	-	-	1.3	6.8	3.2	5.8	4.4#	7.2#	# 5 years
1950	-	-	1	4.0	3	8.7	4	6.3	
G-w. teal									
Av. (45-50)	-	-	2.4#	6.7#	2.5	6.2	5.0°	5.6°	# 5 years
1950	-	-	-	-	3	9.0	5	5.2	° 3 years
Wood duck									
Av. (45-50)	-	-	7.6#	6.3#	10.0	5.9	8.7	5.8	# 5 years
1950	-	-	5	7.4	12	6.1	12	5.3	
Ringneck									
Av. (45-50)	-	-	23.2	6.7	17.0	6.6	8.4	5.6	
1950	-	-	16	8.0	20	7.2	7	6.3	
Golden-eye									
Av. (45-50)	-	-	25.2#	6.2#	9.5	4.6	8.2	4.9	# 5 years
1950	-	-	14	7.8	4	7.5	4	2.3	

Class 1 ... Up to 1/4 grown, i.e. in the down
Class 11 ... 1/4 - 3/4 grown
Class 111 ... 3/4 grown to a-wing

Species Composition of the Breeding Population

The species composition of the breeding population is shown in Table 2.

Table 2. -- Species Composition

Species	Total Population	Percent
Blacks	1302	54.7
Wood duck	347	14.5
Ringneck	299	12.5
B-w. teal	214	9.1
G-w. teal	159	6.4
Golden-eye	51	2.1
Mallard	8	0.3
Unidentified	7	0.3
Scaup	2	0.1
Total	2389	100.0

This table shows that black ducks have increased about nine percent in importance on the area over last year. This is the second time in the past six years that the black ducks have increased their relative importance. Ringnecks, golden-eye, and green-winged teal have also increased in importance, but wood ducks, blue-winged teal, and mallards have decreased slightly from last year.

Population Trends from 1945

The population trends on the study area can be measured by using the breeding population of the first year of the study (1945) as a base datum and measuring the increase or decrease of each species during the following years. These trends are shown in Table 3.

Table 3. -- Population Trends from 1945 (percent)

Species	1946	1947	1948	1949	1950
Blacks	−49	− 9	−24	+84	+111
Wood duck	−80	−68	+16	+82	+ 23
B-w. teal	−88	−87	−70	−31	− 44
Ringneck	+ 3	−49	−18	+11	+ 32
G-w. teal	−14	−78	−74	+33	+ 23
Golden-eye	−63	+189	+85	−41	− 5
Unidentified	−27	--	+ 9	+ 9	− 69
Average	−54	−42	−26	+43	+ 37

The black ducks have shown another large increase over the 1945 level and are in larger numbers than at any time since this study began. Green-winged teal and wood duck show an increase over 1945 but are slightly less in numbers than last year. Blue-winged teal are still below the 1945 level and are about 16 percent less than last year. Ringnecks show an increase of about 14 percent over last year and are 32 percent higher than 1945. The golden-eye show a large increase over last year (63 percent) but are still 5 percent lower than in 1945, however, this may be the start of an upward trend. The total breeding population is, for the second time in six years, above the 1945 level, and shows an average increase of 37 percent over that level but is 3 percent less than last year.

Table 4 shows the total duck population per square mile of open marsh on the study area. A steady increase is shown by this table from 1946 to 1949 with a slight drop-off this year.

Table 4. -- Duck Population per Square Mile of Open Marsh

Year	Ducks per square mile
1945	111.9
1946	53.5
1947	69.4
1948	84.1
1949	165.2
1950	157.6

Conclusion

The 1950 season has been one of the most successful seasons for breeding waterfowl in the St. John Estuary in the last six years, being only slightly poorer than last year. The black duck, the most important game species, has for the second time in succession shown a large gain over the 1945 level. Three other species - green-winged teal, wood duck, and ring-necked duck all show increases over 1945. The largest increase was made by the golden-eye which showed a gain of 63 percent over last year. The golden-eye and the blue-winged teal are the only two species which show no gain over the 1945 level.

OBSERVATIONS ON SUMMERING CONCENTRATIONS OF BLACK DUCKS ON THE GRAND PRÉ-CANARD AREAS OF NOVA SCOTIA - 1950

Ralph Mosher *

Introduction

"During aerial census and ground studies conducted in Nova Scotia, New Brunswick, Prince Edward Island, and Anticosti Island in June-July of 1949 by C. E. Addy, Leon D. Cool (U. S. Fish and Wildlife Service) and G. F. Boyer (Canadian Wildlife Service), relatively large and distinct concentrations of black ducks were tallied on certain saline and fresh marsh areas. On the basis of the doubtful status of such concentrations in the ecology of this species in the Northeast, observations were made of a representative concentration of black ducks on the Grand Pré-Canard saline marshes of Nova Scotia during the period from June 12-July 31, 1950.

The Grand Pré-Canard area, comprising three to four thousand acres of dykeland and saltmarsh habitat, is extensively utilized by black ducks in both spring and fall but supports a relatively small summer breeding population. The discrepancy between negligible brood counts and impressive aerial tallies of adult birds on the Grand Pré gave initial impetus to a study of the latter, an apparent ecological phenomenon previously unknown or overlooked."

Methods and Data Collected

The survey consisted first of a complete inventory of the black duck population throughout the whole area; then protracted observations (from blinds and other means) were made and detailed records were kept of the activities of various flocks. Banding was attempted without success, although a few immature blacks and blue-winged teal were banded on the nearby fresh water Kentville Sanctuary. Unfortunately, only two specimens were collected for study. These will be discussed later.

"Upon arrival in the Grand Pré-Canard region on June 12, a ground survey of the study area was carried out. The use of a dog proved of considerable assistance, since much of the habitat is heavily indented by tidal creeks and gullies forming small islands and promontories inaccessible to the observer. A total of 780 black ducks was tallied during this three-day survey."

During the seven-week period of daily observation close study was made on flocks of blacks varying in number from a few dozen to 485. During the period of study fourteen broods were tallied on the study area giving a ratio of approximately one brood to every fifty-five adults.

In order not to burden the reader with prolonged details of the daily activities of the birds, it might be well to summarize these observations as follows:

a. The flocks studied are "relatively static insofar as locale is concerned." Apparently the same gregarious groups or individuals follow a daily routine when feeding and resting.

* * * * * * *

* Original comprehensive report condensed by C. E. Addy. Quotes direct from Mr. Mosher's report.

b. "Component individuals highly gregarious and generally more nervous than definitely breeding adults."

c. "Both males and females present." At times the sex of certain individuals could be determined by the "quack" of the female or the reedy voice of the male. However, the majority of the birds remained mute. In some instances, particularly in June, the colors of leg and bill aided in sex identification. The exact sex ratio could not be determined from observation alone but it is believed that females probably made up 10 to 15 percent.

d. "The maintenance of migratory characteristics (particularly in flight patterns)." In normal daily routine flights, or when disturbed, the flocked birds generally flew as a group in a line or disorderly formation low to the water or at the most at a height of 50 to 200 feet.

e. The birds appeared to exhibit a "total lack of sexual activity or display."

f. These blacks occur in numbers "sufficiently large to attract immediate attention" and that they seem to have "an affinity for saline marshes at least in Nova Scotia and Prince Edward Island."

g. "The combination of these several characteristics is sufficiently pronounced moreover, that the birds forming such concentrations are generally noticeably distinct from 'other' blacks frequently the same marshes."

h. The total numbers of blacks on the study area gradually reduced after July 1. The moulting of feathers became pronounced during this period. In early July, 1949, two adult, flightless females were banded in this area. Apparently a part of the birds moved to other areas during the moulting period.

"Flightless blacks were tallied on the Kentville Sanctuary on and after July 7, and it would seem logical to explain the continuing decrease in the Grand Pre-Canard concentrations in late June and July in terms of a parallel build-up of moulting birds (on either study area or adjacent marshes). Post breeding females could thus be expected to increase late in the latter month and one of specimens collected on July 21 may have belonged to such a classification. Both birds were moulting, but had not lost the power of flight at the time of collection.

"During the course of the study limited surveys of certain fresh water lakes and saline areas in the district adjacent to the Grand Pre-Canard were conducted. These involved censusing of the Black River lake system south of the study area and shoreline tallies at Scott's Bay on the Bay of Fundy; Delhaven and Medford beaches on Minas Basin. Waterfowl counts were entirely negligible on all of these locales.

"Three days were spent on the saline marshes of the Annapolis River, an area essentially duplicating habitat conditions found on the Grand Pre-Canard. Although the concentrations of summering black ducks there were much smaller than those on the study area, the various characteristics outlined above applied with equal validity. Again the contrast between apparent breeding blacks and summering birds of same species was most striking.

"Two specimens only were collected from sample groups, and these on July 21, when the period of study was nearly completed. Both were adult females, the ovary of one being apparently entirely atrophied, that of the second bird healthy but inactive. Cross sections of the ovary from the latter specimen are now in process of preparation for examination; blood smears from the abdominal cavity of both birds were also prepared for study. Liver cultures prepared from two specimens by Acadia University

lab technicians evidenced tentative presence of Clostridium botulinum but as this bacteria is a product of putrefaction its presence in live birds is not established. It was felt, however, that the rapid degree of decomposition of refrigerated birds indicated a diseased condition of some type. Weights of the two specimens were 1201.8 and 1126.4 grams, and the stomachs of both contained a heavy percentage of Mya arenaria remains. It is obvious that the above-detailed specimens were collected too late in the breeding season for purposes of definite conclusions as to their particular status.

"During May and early June of this year the writer assisted in waterfowl-crow studies conducted by the Canadian Wildlife Service on Prince Edward Island. On at least four of the Island's principal waterfowl areas (Black Pond Sanctuary; Clark's Brook; Dunk River; South Arm Dunk River) smaller concentrations of black ducks apparently identical in status to those studies on the Grand Pré-Canard were encountered. On May 14, at Black Pond Sanctuary, 69 blacks were observed feeding on exposed sand bars of Little Harbor pond, a sheltered saline cove immediately adjacent to the sanctuary proper. No tendency toward pairing could be noted and when flushed, the birds displayed characteristics peculiar to migrating blacks such as the writer witnessed at Tinker Harbor, Labrador, in September of 1949. On May 26 a similar group of 30 birds was tallied on the marsh at the mouth of Clark's Brook on the Upper Hillsborough River.

"On June 2, 43 blacks were noted tipping and resting in the lee of a sand bar which projects into the breakers at the mouth of Black Pond outlet. When flushed, the birds took flight in a body and strung out into the wind in line formation with groupings of 5-14. One of the latter settled on Black Pond itself, and was studied at close range for approximately 20 minutes. Two of the component birds were females, the remaining eleven probably males.

"Similar concentrations on the Dunk River proper and the South Arm of the same added emphasis to the contention that the summering black duck phenomenon is neither localized geographically nor unimportant ecologically."

Conclusion

"Concentrations of summering black ducks have usually been explained in terms of groupings of adult males whose breeding functions were completed. The presence of females in numbers perhaps as high as 10-15 percent of the total of such flocks throws an entirely different light on the situation; if females are consistently present, or component males prove sexually inactive in other similar concentrations throughout the northeast, then considerable revision of present theories insofar as black duck breeding ecology may be in order.

"The wide discrepancy between broods and adult birds observed in the Grand Pré-Canard areas has already been stressed, and it is obvious that the bulk of the brids comprising the flock studies in June could not have been breeding on these same marshes. The significance of this situation insofar as breeding ground censuses and brood production expectancy on basis of adult birds tallied is immediately obvious. The possibility of concentration from widely scattered areas in the Maritimes is conceivable, but aerial surveys in other Maritime habitats support the contention of heavy divergence between adult population and broods produced. Although summering black ducks are apparently mainly a saline marsh phenomenon (on the St. John River possible similar groupings were encountered on non saline areas) it would seem safe to assume that an explanation on the basis of a concentration of post-breeding males and to a lesser extent, post-breeding females, requires further substantiation before acceptance.

"The possibility that a heavy percentage of both males and females encountered in such relatively static groups of blacks may be non-breeding birds can hardly be dismissed. At no time during the study was anything approximating sexual activity observed, and while studies were undoubtedly begun late in the breeding season it would seem natural to expect some such displays in large groups containing both unmated males and females.

"A discussion of reasons for non-breeding can at the present time involve little more than speculation: whether the birds may be sexually immature (not breeding in first year); adults sterile because of lead poisoning or other cause; adults sexually mature but non-breeding because of lack of suitable nesting habitat; immatures unsuccessful in mating or combinations of any above is something only further studies can reveal. To insure establishment of a full case history such studies should begin on sample areas no later than April 1-15, and continue at least at regular intervals until about August 1, of any breeding and post-breeding season. Collection and competent pathological analysis of a number of specimens sufficient to guarantee validity of data would appear an essential component of any further investigations. Banding of birds from these flocks where feasible (possibly at Black Pond Sanctuary, Prince Edward Island) would provide interesting but perhaps not essential information. The markings of sample individuals (by airplane dope or other feasible method) would be a decided aid to study."

WATERFOWL BREEDING GROUND SURVEY IN WASHINGTON - 1950

Henry A. Hansen, Wendell H. Oliver
and
Robert G. Jeffrey

Introduction

The 1950 waterfowl breeding ground survey represents the third annual study carried on in the State of Washington and is part of an integral study in the Pacific Flyway by seven western states, plus British Columbia and Alaska. This study is a coordinated project aimed at bringing together all information and research on waterfowl of the Pacific Flyway so that management and wise utilization of this great natural resource can be most adequately adjusted to serve the sporting desires of the public to whom it belongs.

Method of Sampling

For purposes of study, the State of Washington is divided into three waterfowl study areas. These areas are: Western, Central, and Eastern Washington. All primary breeding grounds in each area are included in the study. In Eastern Washington there are six major waterfowl breeding areas consisting of potholes and lakes which produce approximately 85 percent of the waterfowl in the State. In Central Washington there are two major waterfowl breeding areas which are divided into habitat units and which produce approximately 8 percent of the waterfowl in the State. The remaining waterfowl are produced in the thinly distributed breeding ground habitat in Western Washington.

The 1950 breeding ground survey of Eastern Washington was conducted for the fourth consecutive year under similar conditions and largely by the same personnel. Some refinements in censusing techniques have been made each year so that the data for 1950 are more complete and accurate than heretofore. Aerial habitat mapping and surveys facilitated the ground work enough that more expansive coverage of the total nesting habitat was possible. The production inventory started on the first of June and extended uninterrupted through the middle of August. H. A. Hansen and C. F. Yocom, of the Washington State Game Department, conducted the major part of the ground inventory. Homer Ford, summer student employed at the Turnbull National Wildlife Refuge, assisted in gathering data used from the Refuge. Kenneth Gehrman and Stanley Harris, graduate students in game management at Washington State College, gathered data used from the Medical Lake area of Spokane county and the Moses Lake area of Grant county during their research studies in the respective areas. Hansen and L. A Wadkins, of the Washington State Game Department, made the aerial surveys at regular intervals during the summer.

Random ground transects were run in all areas except one. In the potholes region south of Moses Lake in the Columbia Basin, an attempt was made to get a complete coverage of the 889 individual potholes. Although many of the ponds were dry before the summer inventory was completed, it is estimated that a 90 percent coverage of the potholes area was made. The random samples of the remaining five areas are representative of the entire waterfowl habitat of those areas.

In Central Washington a variety of ground sampling methods were used by Wendell H. Oliver. In South Central breeding units, measured linear samples of one mile, or equal portions of a mile, totaled 143 miles in sampling 1,163 miles of linear habitat (creeks, rivers, irrigation ditches, and drain ditches). All counts of swamps, lakes, and ponds in the units were assumed complete. Average waterfowl population

per lake and pothole was calculated for two of four North Central Washington breeding units based on observation of 83 lakes and potholes. A minimum of 248 lakes and potholes were located by aerial counts.

In Western Washington waterfowl production, estimated by Robert G. Jeffrey, were based on sample counts made within the various breeding habitats.

Weather and Water Conditions

A prolonged, cold spring retarded early nesting waterfowl throughout most of the State. In Eastern Washington, which is the major waterfowl production area, these conditions had some detrimental effects on mallard production. Surface water conditions were more favorable in June of 1950 than for the same period of 1949. In Central Washington early nesters were retarded. However, an excessive run-off created better habitat bordering streams. Retarded vegetation caused some desertion among nesters and provoked a slight shift of the breeding population to more sheltered habitat. In Western Washington, although nesting was retarded, no serious losses resulted from the weather.

Breeding Population Trends

In Eastern Washington, the major waterfowl producing area, the same sixteen species of ducks and Canada geese and coots which were found in previous summers, were recorded again in 1950. There was a considerable change in relative abundance, and total abundance of some species. Although there was about a 35 percent decline in mallard production in the broods in 1950, the mallard still remained the most abundant duck in the area. Mallards were followed in abundance by blue-winged teal, gadwall, redhead, baldpate, and ruddy ducks, respectively, each species having had more than 100 broods tabulated during the summer.

Table 1 summarizes by area, all the broods observed and their relative abundance during the summer of 1950. Gadwall, ruddy ducks, shovelers, and pintails increased substantially over their 1949 production, while redheads, and the blue-winged/ cinnamon teal group decreased. There is some indication from the spring ratio count of resident males in breeding plumage that the teal decline was about equal in both species.

Table 1. -- Total Broods Observed by Areas in Eastern Washington, 1950

(Number in parenthesis is percentage of total broods for each species)

Species	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Misc.	Total
Mallard	38 (18.0)	54 (33.3)	45 (21.4)	24 (7.7)	61 (18.5)	15 (11.6)	17 (65.4)	254 (18.4)
Redhead	14 (6.6)	21 (13.0)	22 (10.5)	25 (8.1)	7 (2.1)	30 (23.3)	1 (3.8)	120 (8.7)
Ruddy duck	8 (3.8)	10 (6.2)	20 (9.5)	2 (7.1)	5 (1.5)	36 (27.9)	2 (7.7)	103 (7.5)
Gadwall	33 (15.6)	10 (6.2)	20 (9.5)	37 (11.9)	28 (8.5)	7 (5.4)		135 (9.8)
Baldpate	6 (2.8)	9 (5.6)	4 (1.9)	38 (12.3)	42 (12.8)	8 (6.2)		107 (7.8)
G-w. teal	29 (13.7)	1 (0.6)	16 (7.6)	14 (4.5)	21 (6.4)	1 (0.8)		82 (6.0)

Table 1. -- (continued)

Species	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Misc.	Total
Shoveler	20 (9.5)	(0.0)	18 (8.6)	15 (4.8)	27 (8.2)	2 (1.6)		82 (6.0)
B-w. & Cinn. Teal	31 (14.7)	16 (9.9)	39 (18.6)	67 (21.6)	65 (19.8)	10 (7.8)		228 (16.6)
Pintail	17 (8.0)	2 (1.2)	14 (6.7)	17 (5.5)	8 (2.4)	3 (2.3)	1 (3.8)	62 (4.5)
Scaup		17 (10.5)		29 (9.4)	7 (2.1)	10 (7.8)		63 (4.6)
Canvasback		3 (1.9)		5 (1.6)				8 (0.6)
Golden-eye					10 (3.0)		1 (3.8)	11 (0.8)
Wood duck							3 (11.5)	3 (0.2)
Canada goose	2 (0.9)	11 (6.8)			11 (3.3)			24 (1.7)
Unid. teal	2 (0.9)	(0.0)		7 (2.3)	11 (3.3)	4 (3.1)		24 (1.7)
Unidentified	11 (5.2)	8 (4.9)	12 (5.7)	10 (3.2)	26 (7.9)	3 (2.3)	1 (3.8)	71 (5.2)
Coots	12	32	157	53	44	9	2	309
Total Waterfowl	211	162	210	310	329	129	26	1377
Grand Total	223	194	367	363	373	138	28	1686

Resident Waterfowl Population and Population Trend

A brood inventory alone does not seem adequate to properly evaluate population trends or total production for an area as large and diverse as Eastern Washington. Correlated with the brood studies is our count of all resident waterfowl encountered on the transects. In checking these annual tabulations against each other, area by area, we have arrived at a production trend and an estimated total production for Eastern Washington. Table 2 lists the resident waterfowl observed during the 1950 breeding season. The mallard decline becomes very obvious when the inventory figures for 1950 are compared with those of 1949. Under similar conditions, and with a comparable expenditure of time and effort both summers, roughly 35 percent fewer broods were tabulated in 1950. Similarly, 45 percent fewer mallard ducks, adult plus juvenile, were counted in 1950. The above difference of 10 percent between broods and total ducks can be accounted for, in part at least, by a decrease of 13 percent in brood size of age class 111 in 1950. There seemed to be about a 15 percent decrease in redhead production in 1950. There was 20 percent fewer redhead broods counted but only 14 percent fewer total redhead ducks tabulated. The average brood size of age class 111, however, was 10 percent higher than in 1950. In the two-year comparison of all other important species there was fairly good correlation between total broods counted and total ducks counted.

Through a combination of ground transects and the aerial survey of all the important waterfowl areas in Eastern Washington, we feel that we are arriving at a

sound basis for estimating total production. There is still need for better refinement of the sampling technique, especially in the large forested areas in the four northeastern counties of the State.

Table 2. -- Resident Waterfowl Observed in Eastern Washington, Summer 1950

(Number in parenthesis is the percentage of total identified waterfowl for the area listed)

Species	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Misc.	Total
Mallard	1249 (33.5)	1204 (44.5)	354 (22.0)	1307 (28.0)	941 (20.4)	1167 (39.1)	290 (57.0)	6512 (31.3)
B-w. or Cinn. Teal	532 (14.3)	290 (10.7)	328 (20.4)	730 (15.6)	708 (15.3)	237 (7.9)	15 (2.9)	2840 (13.6)
Baldpate	123 (3.3)	224 (8.3)	34 (2.1)	527 (11.3)	431 (9.3)	255 (8.5)		1594 (7.7)
Redhead	182 (4.9)	277 (10.2)	154 (9.6)	246 (5.3)	128 (2.7)	272 (9.1)	28 (5.5)	1287 (6.2)
Scaup	71 (1.9)	223 (8.2)		393 (8.5)	382 (8.3)	190 (6.4)		1259 (6.1)
Ruddy	155 (4.2)	201 (7.4)	135 (8.4)	274 (5.9)	180 (3.9)	296 (9.9)	16 (3.1)	1257 (6.0)
G-w. teal	443 (11.9)	37 (1.4)	153 (9.6)	192 (4.1)	244 (5.3)	117 (3.9)	4 (.8)	1190 (5.7)
Pintail	242 (6.5)	16 (.6)	78 (4.9)	264 (5.7)	256 (5.5)	167 (5.6)	73 (14.3)	1096 (5.3)
Shoveler	165 (4.4)	2 (.07)	169 (10.5)	160 (3.4)	243 (5.3)	51 (1.7)	3 (.6)	793 (3.8)
Canada goose	6 (.2)	73 (2.7)	27 (1.7)		491 (10.6)	4 (.1)	3 (.6)	604 (2.9)
Unid. teal	134 (3.6)	16 (.6)		118 (2.5)	149 (3.2)	111 (3.7)	3 (.6)	531 (2.6)
Canvasback	1 (.03)	11 (.4)		36 (.8)	1 (.02)	1 (.03)		50 (.2)
Barrow's Golden-eye	5 (.1)	5 (.2)			114 (2.5)		16 (3.1)	140 (.7)
Wood duck	2 (.05)	2 (.07)		6 (.1)	1 (.02)		19 (3.7)	30 (.1)
Ring-necked duck	(0.0)	4 (.1)		3 (.1)	1 (.02)	13 (.4)	33 (6.5)	54 (.2)
Bufflehead	22 (.6)	1 (.04)	2 (.1)	24 (.5)	10 (.2)			59 (.3)
Hooded merganser	4 (.1)				3 (.07)			7 (.03)
American merganser					1 (.02)		6 (1.2)	7 (.03)
Total Ident.	3730	2706	1608	4670	4615	2987	509	20,825
Coots	293	461	998	775	637	756	39	3,959
Unidentified	225	21	95	137	10,180	64	2000	12,722
Grand Total	4248	3188	2701	5582	15,432	3807	2548	37,506

Table 3 gives a four-year comparison and summary of waterfowl broods observed in Eastern Washington. The big increase in observed broods during the past two summers over the counts of 1947 and 1948 does not indicate a relative increase in production. Rather, the favorable change is indicative of increased familiarity with the area, and greater returns for the effort expended.

Table 3. -- A Four-Year Comparison of Waterfowl Broods Observed in Eastern Washington

(Number in parenthesis is percentage of total broods for each species)

Species	1947	1948	1949	1950	Total
Mallard	77 (33.5)	158 (30.1)	398 (28.2)	254 (18.4)	887 (25.0)
B-w. and Cinnamon teal	9 (3.9)	21 (3.9)	252 (17.8)	228 (16.6)	510 (14.4)
Redhead	50 (21.7)	34 (6.4)	150 (10.6)	120 (8.7)	354 (10.0)
Gadwall	18 (7.8)	97 (18.3)	79 (5.6)	135 (9.8)	329 (9.3)
Baldpate	16 (7.0)	35 (6.6)	106 (7.5)	107 (7.8)	264 (7.4)
Ruddy	21 (9.1)	47 (8.9)	58 (4.1)	103 (7.5)	229 (6.5)
Green-winged teal	11 (4.8)	29 (5.4)	79 (5.6)	82 (6.0)	201 (5.7)
Scaup	8 (3.5)	33 (6.2)	63 (4.5)	63 (4.6)	167 (4.7)
Shoveler	9 (3.9)	16 (3.0)	48 (3.4)	82 (6.0)	155 (4.4)
Pintail	8 (3.5)	21 (3.9)	38 (2.7)	62 (4.5)	129 (3.6)
Canada goose			39 (2.8)	24 (1.7)	63 (1.8)
Canvasback	1 (.4)	1 (.2)	13 (.9)	8 (.6)	23 (0.6)
Barrow's Golden-eye		2 (.4)	9 (.6)	11 (.8)	22 (0.6)
American merganser		1 (.2)	5 (.1)		6 (0.2)
Wood duck		1 (.2)	1 (.07)	3 (.2)	5 (0.1)
Ring-necked duck			5 (.4)		5 (0.1)
Unidentified	2 (.9)	29 (5.4)	70 (5.0)	95 (6.9)	196 (5.5)
Total	230	525	1413	1377	3545
Coots			94	309	403
Grand Total	230	525	1507	1686	3948

In the Central Washington waterfowl production area, which produces approximately 8 percent of the waterfowl in the State, observation and study by Wendell H. Oliver show the first duck brood of the 1950 season, a mallard brood of 13, was observed on May 1, indicating the first nesting activity of the season to be one week later than in 1949. Early nesting was slow in 1950 as the broods did not appear in volume until mid-July, whereas in 1949 broods were out in volume in June. Eighty-five percent more broods were observed in June of 1949 than in June of 1950. During the past nesting season 22 waterfowl nests were under observance until hatched. From the fate of these nests, it was concluded that 77 percent of the Central Washington nesters were successful in hatching. A summary of nesting observations is presented in Table 4.

Table 4. -- Summary of Nest Observations, 1950

Species	Observed Nests	Total Eggs	Average Clutch	Successful Nests	Percent Success	Reasons for Failure
Mallard	15	111	7.4	12	80.0	Flood, farms & desertion
Gadwall	1	10	10.0	1	100.0	
Pintail	1	7	7.0	1	100.0	
B-w. & Cinn. teal	3	33	11.0	2	66.6	Bird predation
Coot	2	14	7.0	1	50.0	Flooding
Totals	22	175	8.3 av.	17	70.0 av.	

From brood observations, 15 species of ducks were known to breed in Central Washington during 1950, plus Canada geese and coot. An additional species, the hooded merganser, is believed to have been sighted with a brood in the Yakima River backwater near Cle Elum. Identification, however, was not positive. Although somewhat less in relative abundance, the mallard was again in 1950 the most important breeding duck of Central Washington (Table 5). The most pronounced species increase was in wood ducks, the second most abundant breeder in the region for 1950. Gadwall and baldpate also showed increases over the two previous yearly surveys in the south central section of the State. The sharpest decrease in the past three years has occurred in redhead production in South Central Washington. Second in importance as a breeder in 1948, the species has diminished in importance rapidly since. Typical of this decrease is the three year breeding record on a pumping pond on the Indian Reservation of Yakima County. In 1948, nine redhead broods were known on the pond, in 1948 two broods, and in 1950 one brood of one young was observed. Ruddy ducks, breeders in 1948 and 1949, were absent in 1950 in South Central Washington. This species, however, is an important breeder in the North Central section of the State. Barrow's golden-eye was second in relative abundance to the mallard in this section of Central Washington. Coot comprised, roughly, 37 percent of the North Central waterfowl total and 18.3 percent of the total breeding waterfowl in Central Washington.

The average brood size of 226 duck broods in 1950 compares closely with the average brood size obtained in the 1949 survey. The average 1950 duck brood was 5.82 young when two-thirds grown. The mortality between broods of one-third or less in size and broods of two-thirds or more amounted to .94 young lost. Fifteen complete counts of Canada geese were made in South Central Washington areas. An additional 26 complete counts were obtained from game technicians on the Hanford Reservation. Average goose brood, from 41 counts, was 3.9 goslings.

Table 5. -- Identified Duck Broods in Central Washington, 1948, 1949, and 1950

Species	South Central Washington						N. Cent. Wash.		Cent. Wash.	
	1948		1949		1950		1950		1950	
	No.	% Total	No.	% Total	No.	% Total	No.	% Total	No.	% Total
Mallard	145	57.5	274	63.4	221	58.9	50	42.7	271	55.1
Gadwall	2	.8	8	1.8	12	3.2			12	2.4
Baldpate	1	.4	2	.5	3	.8	1	.9	4	.8
Pintail	4	1.6	19	4.4	9	2.4	2	1.7	11	2.2
G-w. teal	7	2.8	12	2.8	11	2.9	2	1.7	13	2.6
B-w. teal**	44*	5.2	60*	7.8	49*	6.2	5*	3.6	54*	5.7
Cinn. teal **		12.2		6.1		6.9		.6		5.9
Shoveler	2	.8	12	2.8	4	1.1			4	.8
Wood duck	11	4.4	20	4.6	47	12.5	5	4.2	52	10.6
Redhead	32	12.7	17	4.0	10	2.7	15	12.8	25	5.1
Ringneck							1	.9	1	.2
W. harlequin			4	.9	2	.5	1	.9	3	.6
B. golden-eye							20	17.1	20	4.1
Ruddy duck	1	.4	3	.6			14	12.0	14	2.9
Merganser	3	1.2	1	.2	7	1.9	1	.9	8	1.6
Identified Total	252		432		375		117		492	
Unidentified	27		40		28		7		35	
Coot			67		45		73		118	
Grand Total	279		539		448		197		645	

* Combined Blue-winged teal and Cinnamon teal broods.

** Representative percentage computed from total observed identified males.

Waterfowl samples in Central Washington totaled 645 broods and 4,530 resident waterfowl (ducks and coot) observed during the summer. No resident counts were made during August. An additional 2,597 Canada geese were counted during the waterfowl inventory, bringing the total resident waterfowl count for the region to 7,127 birds. To gain a population index for individual species and for the region, samples, expressed in averages per mile, were applied to the total sampled habitat within each breeding unit. The Tieton Basin indicated an average of 10.5 pairs of ducks (mallard and wood duck) per square mile and was applied to 15 square miles. Average ducks per lake or pothole in the North Central section was multiplied by the total number of potential lakes in each unit. A 77 percent nesting success was assumed in all territorial counts and the average brood size (5.82) was applied to potential broods. The minimum population of the Canada geese in Central Washington was gained by accepting the total pairs and residents of the spring survey on the Columbia River. North Central Washington's waterfowl population represented 18 percent of the Central Washington summer population, 10,577 waterfowl. South Central Washington had 82 percent, or, 48,095 of the estimated total waterfowl.

Central Washington waterfowl estimates by species (Table 6) indicates 45.7 percent of the waterfowl of the region are mallards. Coot, Canada geese, wood duck, blue-winged teal, and cinnamon teal follow in respective importance. Twenty species of waterfowl were known to reside in two divisions of Central Washington during the summer of 1950, numbering an estimated 58,672 birds, 24,725 adults, and 33,947 produced young.

Table 6. -- Central Washington Waterfowl Population By Species, 1950

Species	North Central Washington			South Central Washington			Cent. Washington	
	Residents	Young	Total	Residents	Young	Total	Total	%Total
Mallard	917	1,479	2,396	12,341	12,033	24,424	26,820	45.7
Gadwall	3		3	135	302	437	440	.75
Baldpate	18	46	64	97	221	318	382	.65
Pintail	18	29	47	204	484	688	735	1.2
G-w. teal	72	29	101	232	499	731	832	1.4
B-w. teal*	175	178	353	746	1,690	2,436	2,790	4.7
Cinn. teal*	31	31	62	826	1,867	2,693	2,754	4.6
Shoveler	13	23	36	187	309	496	532	.9
Wood duck	109	221	330	1,216	2,622	3,838	4,168	7.1
Redhead	353	611	864	330	279	609	1,473	2.5
Ringneck	30	29	59				59	.1
Scaup	3		3	8		8	11	.02
Bufflehead				5		5	5	.01
B. golden-eye	195	438	633	28		28	661	1.1
W. harlequin	4	6	10	130	349	479	489	.8
Ruddy duck	504	652	1,156	19		19	1,175	2.0
Am. merganser	2	6	8	758	417	1,175	1,183	2.01
Hooded merganser				1		1	1	.001
Canada goose				2,597	3,007	5,604	5,604	9.5
Coot	1,159	2,935	4,094	847	1,872	2,719	6,813	11.6
Unidentified	137	221	356	375	1,012	1,387	1,745	2.9
Total	3,643	6,934	10,577	21,082	27,043	48,095	58,672	

* Species totals computed from ratio of identified males.

Waterfowl production studies made by Robert G. Jeffrey in Western Washington were a continuation of work started in 1949 when a series of brood trend plots were established which covered the better waterfowl breeding areas throughout Western Washington. Most of these were located on sections of lakes, river sloughs, and larger drainage ditches. This year, the trend census was repeated and was enlarged by the addition of 14 new samples. The total number of such samples is now 49. However, comparisons in Table 7 represent plots which were censused both years.

Table 7. -- Territorial Pair Counts, 1948, 1949, and 1950

Species	1948	1949	1950
Mallard	63% (55)	54% (70)	50% (35)
Baldpate		2% (2)	
Pintail	1% (1)	1% (1)	
G-w. teal	1% (1)	18% (11)	14% (10)
B-w. & Cinn. teals	7% (6)	26% (34)	17% (12)
Shoveler	7% (6)	2% (2)	1% (1)
Wood duck	21% (18)	8% (10)	17% (12)
Totals	100% (87)	101% (130)	99% (70)

Each year represents five counts made within the period from April 20 to June 25.

Mallard - 50% decrease, approximately, from last year.
Green-winged teal - About the same as last year.
Blue-winged/Cinnamon teals - 65% decrease from last year.
Wood duck - Probably up slightly from last year.

Table 8. -- Brood Counts, 1948-1950

Species	1948	1949	1950
Mallard	60% (25 broods)	73% (45)	70% (23)
Pintail		2% (1)	
G-w. teal	2% (1)	5% (3)	3% (1)
Cinnamon & B-w. teals		10% (6)	6% (2)
Wood duck	26% (11)		12% (4)
Coot	12% (5)	11% (7)	9% (3)
Totals	100% (42)	101% (62)	100% (33)

Each year represents four counts made within the period from May 19 to July 23.

Mallard - 50% decrease, approximately, from last year.
Blue-winged and Cinnamon teals - Down approximately 65%.
Wood duck - Up from last year, when no wood duck broods were seen on the census plots.

It is realized that the samples, although fairly large in area, are too small to provide adequate information on the thinly distributed breeding population in Western Washington. This year, additions have been made to all sample areas, so that comparisons will be available for the 1951 season.

From the information available, it appears that mallards are off between 40 and 50 percent, wood ducks have increased somewhat in the northern part of the region but are down elsewhere, and blue-winged teal and cinnamon teal are down considerably from last year. All species of ducks taken together are down between 45 and 50 percent from last year.

Success of the Season

From an examination of Table 9 it can readily be seen that there is no significant change in brood sizes during the last three years from counts made all over the state.

Table 9. -- Average Brood Size, By Age Classification For State
Three-year Comparison Of All Species

Area % Grown --	1948 1/3	1948 1-2/3	1948 2/3	1949 1/3	1949 1-2/3	1949 2/3	1950 1/3	1950 1-2/3	1950 2/3
E. Wash. - No. Broods	205	117	174	312	530	456	548	415	290
Av. Brood	7.19	6.63	6.13	7.15	6.47	6.56	6.47	6.40	6.48
C. Wash. - No. Broods	-	-	-	94	53	95	69	70	84
- Av. Brood	-	-	-	6.85	6.38	5.91	6.52	5.90	5.82
W. Wash. - No. Broods	14	12	6	26	27	28	34	25	18
Av. Brood	6.6	5.0	4.8	7.7	5.7	5.9	7.6	6.0	6.3
Total State *	219	129	180	432	610	579	651	510	395
	7.14	6.51	6.03	7.16	6.42	6.75	6.55	6.33	6.40

* Average brood sizes for the State are computed from weighted figures based on the amount of waterfowl produced in each area.

From the findings of the waterfowl biologists working in the three major waterfowl areas in the State, an estimate of the total waterfowl production is made. Table 10 is a summary of the waterfowl production for the State of Washington.

Adult resident birds are included in the total waterfowl production estimates. It should be pointed out that the increased production figures are a result of greater coverage of the waterfowl habitat and increased knowledge of waterfowl conditions. It is felt that the coverage of the State is now adequate and that the figures for 1950 are now representative of the waterfowl produced in the State. Young produced in the State is roughly 70 percent of the total production figure given.

Although there was a slight loss in production of mallards during the 1950 breeding season, other nesters increased to cover this loss, thus allowing the production of waterfowl to be nearly as successful as during the past two years.

Table 10. -- Waterfowl Production in the Three Divisions of the State, 1948, 1949, 1950

Major Divisions	1948 Production	1949 Production	1950 Production
Western Washington	20,000	58,000	41,418
Central Washington	20,000	26,400	58,672
Eastern Washington	110,000	507,300	708,153
Total State Population	150,000	591,700	808,243

Waterfowl Banding

During the summer quarter 218 ducks and 172 Canada geese were banded. This included 175 mallards, 13 pintail, 7 redhead, 3 gadwall, 1 shoveler, 1 green-winged teal, and 1 coot.

Summary of Data

1. A prolonged, cold spring retarded early nesting waterfowl throughout the State.

2. Although mallard production was lower than the two previous years, they were still the most abundant species in the State.

3. The decrease in mallard production was offset by an increase in the production of other species, thus making the total waterfowl production essentially the same as in 1949.

4. Brood sizes on all species of ducks have remained essentially the same during the past three years.

5. The lakes and potholes of Eastern Washington produce about 85 percent of the waterfowl in the State.

WATERFOWL BREEDING GROUND SURVEY IN OREGON, 1950

William B. Morse

Introduction

The purpose of this survey is to measure waterfowl production trends throughout the State. This is the second year such a survey has been made.

Samples are located in each of the 13 game districts of the State and all measurements are made by the resident game biologists.

Methods

The strip count or transect method of sampling is used. Samples are run by foot and car. Owing to personnel changes, it was impossible to run the samples in the Klamath Basin this year. Data for 1949 in the comparative tables have been recomputed without the Klamath samples to allow a more exact comparison of trends. Samples, particularly in Eastern Oregon, are generally located on choice habitat and do not indicate over-all production for the State as a whole.

Data Collected

Weather and water conditions were generally good, with a run-off above average. Spring migrations and nesting season were about one to two weeks later than in 1949.

Breeding population trends (See Tables 1, 2, 3, and 4). This census shows the following increases:

East of Cascades: $\pm$157 percent
West of Cascades: $\pm$ 70 percent

State-wide increase: Estimated $\pm$ 125 percent

Success of the Season

Data on broods are presented in Tables 5, 6, and 7. Substantial increases in all sections of the State were noted during the entire season.

Summary

All measurements indicate that substantial increases in breeding populations and production occurred during 1950. However, samples are not large, and some of this increase may lie within the statistical probable error; therefore, it is believed that the actual increase is not as great as indicated by the figures.

Table 1. -- Oregon Waterfowl Breeding Population East of Cascades, 1950

Sq. Miles Censused	Species	Pairs Seen	Single Drakes Seen	Total Pairs	Total Ducks	Pairs per Sq. Mile	Ducks per Sq. Mile
19.25	Mallard	287	67	354	708	18.4	36.8
	Pintail	41	14	55	110	2.85	5.7
	Cin. Teal	232	8	240	480	12.41	24.82
	Blue W. Teal	4	-	4	8	.02	.04
	Gadwall	119	7	126	252	6.53	13.06
	Redhead	68	4	72	144	3.73	7.46
	Canvasback	7	-	7	14	.04	.08
	Ruddy	11	6	17	34	.88	1.76
	Shoveler	40	9	49	98	2.54	5.08
	Canada Goose	146	*	146	292	7.56	15.12
	TOTAL	955	115	1,070	2,140	55.58	111.16

* Only pairs of geese counted.

Table 2. -- Oregon Waterfowl Breeding Population West of Cascades, 1950

Sq. Miles Censused	Species	Pairs Seen	Single Drakes Seen	Total Pairs	Total Ducks	Pairs per Sq. Mile	Ducks per Sq. Mile
27.8	Mallard	56	36	92	184	3.30	6.60
	Pintail	10	3	13	26	.47	.94
	Cin. Teal	4	-	4	8	.14	.28
	Blue W. Teal	2	-	2	4	.07	.14
	Wood Duck	21	11	32	64	1.16	2.32
	TOTAL	93	50	143	286	5.14	10.28

Table 3. -- Comparative Data, Waterfowl Breeding Populations East of Cascades, 1949 - 1950

Species	1949 Pairs per Sq. Mile	1949 Ducks per Sq. Mile	1950 Pairs per Sq. Mile	1950 Ducks per Sq. Mile
Mallard	7.9	15.8	18.4	36.8
Pintail	1.33	2.66	2.85	5.7
Cin. Teal	9.1	18.2	12.41	24.82
Blue W. Teal	-	-	.02	.04
Gadwall	2.07	4.14	6.53	13.06
Redhead	2.51	5.02	3.73	7.46
Canvasback	-	-	.04	.08
Ruddy	-	-	.88	1.76
Shoveler	-	-	2.54	5.08
Canada Goose	9.7	19.4	7.56	15.12
TOTAL	32.7	65.4	55.58	111.16

Table 4. -- Comparative Data, Waterfowl Breeding Populations West of Cascades, 1949 - 1950

Species	1949 Pairs per Sq. Mile	1949 Ducks per Sq. Mile	1950 Pairs per Sq. Mile	1950 Ducks per Sq. Mile
Mallard	1.63	3.26	3.3	6.6
Pintail	-	-	.47	.94
Cin. Teal	-	-	.14	.28
Blue W. Teal	-	-	.07	.14
Wood Duck	.33	.66	1.16	2.32
Canvasback	.04	.08	-	-
TOTAL	2.00	4.00	5.14	10.28

Table 5. -- Comparative Data, Oregon Brood Census

Period	EAST OF CASCADES Broods per square mile 1950	Broods per square mile 1949	Young per square mile 1950	Young per square mile 1949
May	5.8	.9	30.6	4.9
1st half of June	3.6	.41	20.0	2.8
2nd half of June	6.2	.59	39.2	4.7
1st week in July	9.9	1.1	57.2	9.8
2nd week in July	3.4	2.3	22.4	14.46
3rd week in July	22.2	-	148.6	-
	WEST OF CASCADES			
1st half of June	2.3	.88	13.1	5.1
2nd half of June	.61	-	2.4	-
1st half of July	2.3	.94	8.1	7.1
2nd half of July	.8	-	4.6	-

Table 6. -- Brood Census Summary in Oregon, 1950

WEST OF CASCADES

Period	Census Area Sq. Mi.	Species	Total Fem. Censused	% Fem. W/Broods	Average Brood Size Class 1	Class 2	Class 3	Broods Per Sq. Mi.	No. Young Per Sq. Mile
June 1st half	6	Mallard	20	45%	5.4	6	-	1.5	8.2
		Wood Duck	6	67%	6.7	4	-	.7	4.0
		Shoveler	1	100%	-	6	-	.2	1.0
		TOTAL	27	52%	-	-	-	2.3	13.1
June 2nd half	15	Mallard	13	38%	5	6	4.7	.33	1.7
		Pintail	1	100%	-	-	3	.07	.2
		Wood Duck	10	20%	-	2.5	-	.14	.33
		B-W. Teal	1	100%	3	-	-	.07	.2
		Shoveler	1	-	-	-	-	-	-
		TOTAL	26	35%	-	-	-	.61	2.4
July 1st half	9.5	Mallard	17	70%	-	2	5.1	1.3	6.1
		Wood Duck	5	20%	-	-	2	.5	1.0
		Shoveler	1	100%	-	-	2	.5	1.0
		TOTAL	23	61%	-	-	-	2.3	8.1
July 2nd half	20.5	Mallard	18	72%	-	4	6.4	.6	3.9
		Wood Duck	5	20%	-	-	2	.1	.4
		Shoveler	1	100%	-	3	-	.1	.2
		Pintail	1	100%	-	-	4	.1	.2
		TOTAL	25	64%	-	-	-	.8	4.6

Table 7. -- Brood Census Summary in Oregon - East of Cascades, 1950

Period	Census Area Sq. Mi.	Species	Total Fem. Censused	% Fem. W/Broods	Average Brood Size Class 1	Class 2	Class 3	Broods Per Sq. Mi.	No. Young Per Sq. Mile
May	5	Canada Goose	29	*100%	5.3	-	-	5.8	30.6
June 1st half	8.1	Mallard	46	15%	5.5	8.3	-	.9	6.4
		Pintail	13	8%	6	-	-	.1	.7
		Cin. Teal	3	33%	5	-	-	.1	.6
		Gadwall	1	-	-	-	-	-	-
		Redhead	9	45%	6.7	7	-	.5	3.5
		Shoveler	1	-	-	-	-	-	-
		Wood Duck	1	100%	-	3	-	.1	.4
		G-W. Teal	2	100%	4.5	-	-	.2	.4
		Canada Goose	8	*100%	4.4	5.3	-	1.0	4.7
		Coot	5	100%	4.3	4	-	.6	2.5
		TOTAL	89	32.5%	-	-	-	3.6	20.0
June 2nd half	2.75	Mallard	10	-	-	-	-	-	-
		Pintail	4	-	-	-	-	-	-
		Cin. Teal	2	-	-	-	-	-	-
		Gadwall	2	-	-	-	-	-	-
		Redhead	7	-	-	-	-	-	-
		Scaup	14	-	-	-	-	-	-
		B-W. Teal	1	-	-	-	-	-	-
		Ruddy	8	-	-	-	-	-	-
		Canada Goose	17	*100%	-	6.1	10	6.2	39.2
		Merganser	7	-	-	-	-	-	-
		TOTAL	72	23.6%	-	-	-	6.2	39.2
July 1st week	8.5	Mallard	14	72%	7.2	5.3	10	1.2	8.1
		Pintail	4	75%	7	-	8	.4	2.6
		Cin. Teal	17	88%	6.6	6	-	1.8	11.4
		Gadwall	2	100%	8	-	-	.2	1.9
		Redhead	9	78%	6.7	6	9	.8	5.9
		Ruddy	6	67%	4.5	-	-	.5	2.1
		G-W. Teal	2	100%	5	-	-	.2	1.2
		Scaup	3	33%	6	-	-	.1	.7
		Canada Goose	40	*100%	-	4.4	5.2	4.7	23.3
		TOTAL	97	87%	-	-	-	9.9	57.2
July 2nd week	5.6	Mallard	26	19%	9	-	7.7	.9	7.3
		Pintail	10	10%	8	-	-	.2	1.4
		Cin. Teal	1	-	-	-	-	-	-
		Gadwall	9	22%	11	5	-	.4	2.9
		Wood Duck	3	100%	6.5	4	-	.5	3.0
		Shoveler	1	-	-	-	-	-	-
		B-W. Teal	2	-	-	-	-	-	-
		Ruddy	9	22%	-	5	-	.4	1.8
		Scaup	4	-	-	-	-	-	-
		Canada Goose	6	*100%	-	5.7	5.3	1.1	5.9
		TOTAL	71	27%	-	-	-	3.4	22.4

*No attempt made to count female geese without broods.

(continued)

Table 7. -- (continued)

Period	Census Area Sq. Mi.	Species	Total Fem. Censused	% Fem. W/Broods	Average Brood Size Class 1	Class 2	Class 3	Broods Per Sq. Mi.	No. Young Per Sq. Mile
July 3rd week	5	Mallard	21	72%	9.2	7.5	-	3.0	26.8
		Pintail	4	25%	5	-	-	.2	1.0
		Cin. Teal	12	91%	5.3	10	7	2.2	13.6
		Gadwall	30	100%	8.5	-	10	6.0	49.6
		Redhead	12	75%	5.4	7	-	1.8	13.2
		Ruddy	2	100%	5	-	-	.4	2
		Canada Goose	43	*100%	-	-	4.9	8.6	42.4
		TOTAL	124	89%	-	-	-	22.2	148.6

* No attempt made to count female geese without broods.

WATERFOWL BREEDING GROUND SURVEY IN CALIFORNIA, 1950

John E. Chattin, A. W. Miller and J. A. Blaisdell *

Introduction

During the spring and early summer of 1950 the waterfowl breeding ground survey was continued in essentially the same manner as in 1949 throughout the principal waterfowl habitat in the State. By way of review it should be noted that under existing conditions the primary waterfowl production area in California lies in the northeast or "Great Basin" corner of the State. This area contains numerous natural marshes and artificial water impoundments on which over one-half of the ducks in the State are raised. The scattered distribution of water areas within this great basin type region makes it impossible to fly aerial transects. As a result, this entire area was given complete aerial coverage of all water and marsh areas to determine total numbers of breeding waterfowl.

The second important waterfowl production area in the State is the valley of the Sacramento River. Under present conditions the Sacramento Valley serves to produce about one-fourth of the State-reared waterfowl. The bulk of this area is devoted to intensive agriculture with only a remnant of the once vast marshlands remaining. These remaining marsh and overflow lands are largely in private ownership and are controlled primarily by private duck clubs. Coupled with these remnants of marshlands the culture of rice as a commercial crop is responsible for a large proportion of the waterfowl raised in this area. From late April through the middle of September, over 200,000 acres of shallow, stabilized water in the form of contoured rice fields are available to nesting ducks. Before the rice becomes too high, this area can be ideally covered by aerial transect flights as was done in 1949 and again this year. Later in the season, however, brood counting and fall population counts are difficult to accomplish due to the dense cover growth and inaccessible nature of these areas on foot. In contrast to northeastern California, where a variety of waterfowl species nest, the primary species nesting in the Sacramento Valley is the mallard.

The remaining quarter of the waterfowl produced in California are raised in scattered sections of agricultural and marsh habitat, including tidal saltmarsh, stream channels and artificial impoundments. These areas include the Suisun marsh, Sacramento-San Joaquin river delta, the Grasslands in the San Joaquin Valley. Productivity is high on these smaller areas in many cases but is limited in significance by the relatively small size of area and amount of water. Production surveys of these minor areas have been repeated this year only where time and convenience enabled us to do so.

Scope and Methods

Insofar as possible the areas covered, census routes travelled, and methods employed, have been duplicated from the pattern established last year. Essentially the same observers have been used in each area as were used in 1949.

All the aerial transects were flown at elevations of 150 feet at speeds of 85 to 90 miles per hour with two observers covering a ground strip 1/8 mile wide on either side of the airplane. Under existing conditions experienced observers were able to record accurately the species and sex of those ducks exhibiting divergent sex characteristics as well as note whether the birds occurred as pairs, singles, or groups of males.

---

* Personnel of Federal Aid in Wildlife Restoration Project California 30-R cooperated in this study. Credit is also due the various waterfowl refuge supervisors of both State and Federal Refuges in California for lending assistance in gathering certain of the field data.

Results

During the spring and summer of 1949 it was estimated that approximately 82,400 pairs of ducks nested in California, raising an estimated 320,000 young. The total fall resident population of young plus adults was estimated to be about 485,000 ducks.

Comparable data is available this year on the spring survey of nesting pairs for those areas of the State which last year yielded 90 to 95 percent of the State's total waterfowl production. Comparable figures of nesting pairs of ducks are presented in the following paragraphs with a summary of pertinent data for each unit area. Also included are the tables on the total fall population of young plus adults for both 1949 and 1950.

1. Sacramento Valley

   a. Area - 2,400 square miles.
   b. Type - Agricultural land including 200,000 + acres of rice, plus managed refuges and private gun clubs.
   c. Coverage - 2 1/2 percent aerial 1949 and 1950.
   d. Production Summary:

Species	Estimated Total Nesting Pairs 1949	1950	Total Fall Population 1949	1950
Mallard	28,000	28,920	140,000	145,000
Gadwall	200	120	1,000	750
Pintail	120	40	600	250
Cinnamon teal	600	440	3,000	2,500
Redhead	40	0	200	0
Total	28,960	29,480	144,800	148,500
Coot	500	1,140	2,000	5,000

   e. Remarks:
   No significant change. Nesting pairs in 1949 represented 35 percent of the State total. Nest studies within the area showed decreased nesting success. This was due to less intensive predator control on the specific study areas and thus did not apply to the entire Sacramento Valley.

2. Suisun Marsh

   a. Area - 140 square miles.
   b. Type - Natural tidal saltmarsh, river channels, gun clubs and agricultural and pasture land.
   c. Coverage - Aerial 6 percent - 1949, 5.5 percent - 1950.
   d. Production Summary:

Species	Estimated Total Nesting Pairs 1949	1950	Total Fall Population 1949	1950
Mallard	3,485	1,913	18,000	10,000
Gadwall	187	180	950	900
Cinnamon teal	68	54	350	350
Others	50	180	250	1,000
Total	3,790	2,327	19,550	12,250

e. Remarks:

35 percent decrease. Nesting pairs in 1949 were 4.6 percent of the State total. Based on this sample the decrease in nesting mallards appears significant for this local area.

3. North San Francisco Bay

a. Area - 36 square miles 1949; 30 square miles 1950.
b. Type - Tidal saltmarsh, gun clubs, river delta and pasture land.
c. Coverage - Aerial 12 1/2 percent 1949, 10 percent 1950.
d. Production Summary:

Species	Estimated Total Nesting Pairs 1949	1950	Total Fall Population 1949	1950
Mallard	575	806	2,800	4,000
Gadwall	40	56	200	300
Pintail	5	9	25	50
Shoveler	10	9	50	50
Ruddy	0	74	0	350
Total	630	954	3,075	4,750

e. Remarks:

35 percent increase. Nesting paris in 1949 were only 0.7 percent of the State total. Based on this sample, this increase appears significant for this local area but unimportant on a State-wide basis.

4. North San Joaquin Valley (Grasslands)

a. Area - 150 square miles.
b. Type - Gun clubs and flooded pasture lands.
c. Coverage - Aerial 25 percent 1948, 1949, and 1950.
d. Production Summary:

Species	Estimated Total Nesting Pairs 1948	1949	1950	Total Fall Population 1949	1950
Mallard	712	1,216	1,304	5,400	6,600
Gadwall	176	156	56	675	300
Pintail	8	16	24	75	150
Shoveler	10	24	8	100	60
Redhead	44	28	20	130	100
Fulvous tree duck	6	0	6	---	40
Ruddy	4	12	32	50	180
Cinnamon teal	140	192	76	950	500
Total	1,100	1,644	1,526	7,380	7,930
Coot	200	400	446	1,600	2,000

e. Remarks:
7 percent decrease in nesting pairs off-set by increased brood survival and nest success resulting in slight over-all increased production. Nesting pairs in 1949 were 2 percent of the State total.

5. Northeastern California

a. Area - not determined.
b. Type - natural marshes, lakes, and artificial impoundments.
c. Coverage - Aerial, complete 1949 and 1950.

d. Production Summary:

Species	Estimated Total Nesting Pairs 1949	1950	Total Fall Population 1949	1950
Canada goose	1,460	1,950	9,538	12,000
Mallard	2,550	2,650	9,900	10,500
Gadwall	2,240	1,660	8,300	9,000
Pintail	1,400	1,750	5,350	6,800
G-w. teal	50	10	150	60
B-w. teal	115	100	430	680
Cinnamon teal	2,600	2,360	9,600	14,000
Shoveler	600	670	2,200	2,900
Redhead	440	520	2,500	3,000
Scaup	70	60	400	400
Ruddy	540	275	2,500	1,800
Others	280	250	1,200	1,200
Total	10,885	10,305	42,530	50,340
Coot	1,020	1,450	4,150	7,400

e. Remarks:
No significant change in nesting pairs of ducks. Increase in Canada geese. Water levels on lakes and reservoirs were higher this year resulting in increased production. In 1949 many young ducks failed to reach maturity due to drying up of ponds.

6. Tule Lake and Lower Klamath Refuges (Klamath Basin)

a. Area - 35,000 acres of water and marsh with surrounding cultivated grain lands.
b. Type - Great Basin. Natural and managed marsh area.
c. Coverage - Ground observation (1949 and 1950)
d. Production Summary:

Species	Estimated Total Nesting Pairs 1949	1950	Total Fall Population 1949	1950
Canada goose	2,600	1,300	16,900	10,300
Mallard	3,500	3,250	26,000	26,300
Gadwall	3,500	5,500	30,000	48,100
Pintail	380	505	3,625	6,510
G-w. teal	150	80	1,700	1,100
B-w. teal	250	295	2,200	2,560
Cinnamon teal	1,700	2,300	16,000	23,000
Shoveler	550	510	6,400	5,900
Redhead	4,300	5,000	31,000	49,400
Scaup	800	850	6,000	8,400
Ruddy	2,000	3,200	18,000	29,900
Others	300	260	3,000	2,400
Total	17,430	21,750	143,925	203,570
Coot	5,000	5,000	31,500	36,000

e. Remarks:
1949 estimates recorded in Special Scientific Report: Wildlife No. 2, erroneously included many non-breeders as nesting pairs.

Nesting birds on the surrounding agricultural lands in the California section of the Klamath Basin were also included both in the nesting pairs and production figures. The estimates in the present report have been corrected for 1949. Estimates of total fall population for this area include many resident non-breeding ducks, especially divers.

Duck production on this area greatly increased in 1950, largely due to improved conditions on Lower Klamath Refuge. Losses from botulism have been minimal compared to previous years, also making for increased effective production. Nesting Canada geese showed a sharp decrease from 1949.

7. State-wide Trend.

A comparative summary of nesting pairs of waterfowl for this season and last season, together with estimated final fall population including young plus resident adults, is shown in the following table. These figures for each year have been derived from the preceding tables and include only those areas on which comparable census data is available for both years.

Species	Estimated Total Nesting Pairs 1949	1950	Total Fall Population 1949	1950
Canada goose	4,060	3,250	26,438	22,300
Mallard	39,326	38,843	202,100	202,400
Gadwall	6,323	7,572	41,125	59,350
Pintail	1,921	2,328	9,675	13,760
Cinnamon teal	5,160	5,230	29,900	40,350
G-w. teal	200	90	1,850	1,160
B-w. teal	365	395	2,630	3,240
Redhead	4,808	5,540	33,830	52,500
Shoveler	1,184	1,197	8,650	8,910
Scaup	870	910	6,400	8,800
Ruddy	2,552	3,581	20,550	32,230
Others	630	696	4,450	4,640
Total	63,339	66,342	361,660	427,340
Coot	6,920	8,036	39,250	50,400

Remarks:

Duck production for 1950 shows an increase over 1949 of over 15 percent. Increases are recorded in gadwall, pintail, cinnamon teal, redhead and ruddy. Other species of ducks remain essentially the same.

The production of Canada geese for the State shows a decrease from 1949. Of 332 Canada geese banded in late June, 1949, at Tule Lake Refuge, a total of 36 bands have been returned to date from birds shot by hunters. This is a direct return of over 11 percent. This year 672 geese were banded at Tule Lake and Lower Klamath Refuges. Additional banding next summer and spring counts on breeding populations in the future are planned to give a closer check on this population of geese.

Data from Nesting Studies

Studies of nesting were carried on in the Sacramento Valley both in 1949 and 1950 on essentially the same areas. Three separate areas within a 10-mile radius were under study in 1949 as follows:

1. Gray Lodge Refuge - 2,500 acres of ponded, farmed, and undisturbed land, intensive predator control during winters of 1946-47, 1947-48 and 1948-49.

2. Tobin Gun Club - 300 acres of ponded and natural marsh land along Butte Creek. Ideal cover with some predator control.

3. Fenn's Rice - 90 acres of rice field in production. Located near natural marsh. Little or no predator control.

In the spring and early summer of 1950 the three areas under study were as follows:

1. Gray Lodge Refuge - conditions essentially the same as in 1949. No intensive predator control during winter of 1949-50.

2. Tobin Gun Club - essentially the same as in 1949. Located near Gray Lodge Refuge so may have been affected by lack of predator control in 1949-50.

3. Sartain Ranch - 15 miles northwest of Gray Lodge Refuge. Intensively managed small grain agricultural land. Located near natural marsh areas.

A summary of the nesting data gathered during the past two nesting seasons is presented in the following tables.

Nesting Data Summary - Sacramento Valley Study Areas

STUDY AREA:	Gray Lodge		Tobin		Fenn	Sartain
YEAR:	1949	1950	1949	1950	1949	1950
Approx. no. acres searched -	800	400	80	80	90	130
Total nests located -	52	28	27	29	45	71
Acres per nest -	15	14	3	3	2	2
Percent Successful -	69	35	85	66	56	37
" destroyed -	14	61	4	34	33	50
" deserted -	17	4	11	0	11	13
Species Composition in Percent						
of nesting ducks - Mallard -	56	68	56	69	75	82
Gadwall -	27	18	15	10	7	0
Cinn. teal-	17	14	29	21	16	18
Pintail -	0	0	0	0	2	0

Pertinent data evident from this table indicates that nest density was almost identical on the same area in each of the two years. Nesting success was significantly lower on the two comparable areas (Gray Lodge and Tobin) in the 1950 season. Much of this decreased success is attributed to decreased local predator control and probably was not true throughout the whole of the Sacramento Valley in which there is little effort made to control predators on private lands. It is also of interest to note the absence of gadwall nesting on the Sartain study area. The reason for this is at present unknown. Absence of gadwall nesting on agricultural lands was also noted in 1948 on a similar area near Woodland, 100 miles south of this general locality.

	Gray Lodge		Tobin		Fenn	Sartain	TOTALS	
	1949	1950	1949	1950	1949	1950	1949	1950
Average Clutch Size of Successful Nests								
Species - Mallard	8.8	8.8	8.3	8.2	7.8	8.4	8.3	8.4
Gadwall	11.3	10.6	9.8	11.0	10.0	---	10.8	10.7
Cinn. teal	9.1	9.7	10.1	9.7	8.5	10.0	9.5	10.5
Average No. of Eggs Hatched in Successful Clutches - Mallard	6.4	8.7	7.8	7.9	7.2	6.8	7.0	7.5
Gadwall	8.9	9.0*	8.5	12.0*	8.0	---	8.7	10.5
Cinn. teal	8.3	9.0**	9.9	7.8	8.3	10.0	8.9	8.6

* 1 nest
** 2 nests

Clutch size for mallard and gadwall have been constant for both years. Increase in clutch size of cinnamon teal is probably due to the relatively small sample. The average number of eggs hatched in successful clutches for mallard and gadwall shows a slight increase but perhaps is of no significance.

Information relative to date of hatch in the Sacramento Valley is difficult to obtain by methods other than nest observation. Brood observations are difficult to gather on a large scale due to heavy cover in growing rice fields. Based on nest observations, date of hatch in this area was determined to be as follows:

Date of Hatch - Sacramento Valley

Week Period	Percent Nests Hatched - 1949	Percent Nests Hatched - 1950
April 21-30	5	-
May 1 - 7	2	-
May 8 - 14	7	8
May 15 - 21	2	6
May 22 - 28	5	12
May 29 - June 4	28	14
June 5 - 11	33	42
June 12 - 18	9	12
June 19 - 25	7	2
June 26 - July 2	0	0
July 3 - 9	3	2
July 10 - 16	0	2

1949 - Data based on 58 nests of known date of hatch.
1950 - Data based on 50 nests of known date of hatch.

For the past two years the peak of the hatch has occurred during the first half of June with almost 70 percent of nests hatching between the dates of May 29 and June 18 in the Sacramento Valley.

Summary of Banding Operations

Banding operations on locally reared waterfowl were restricted primarily to Canada geese at Tule Lake-Lower Klamath Refuges and at Honey Lake Refuge. Results of these operations were as follows:

	Adult Male	Immature Male	Adult Female	Immature Female	Totals
Honey Lake Refuge	26	68	37	69	200
Tule Lake Refuge	10	119	51	119	299
Lower Klamath Refuge	34	162	38	139	373
Totals	70	349	126	327	872

WATERFOWL BREEDING GROUND SURVEY IN NEVADA - 1950

Fred E. Wright *

Introduction

Examination of Nevada's waterfowl breeding grounds was inaugurated this year to determine its contribution to production. Previous investigations in the State have been limited to the Ruby Lakes National Wildlife Refuge and last year to the Sheldon National Wildlife Refuge and Stillwater Wildlife Management Area, Fallon. The studies conducted at Stillwater Wildlife Management Area have a two-fold purpose; (1) To help guide and evaluate the development work being carried on, and aid in planning management by determining the type of habitat used by waterfowl; (2) To establish production trends and appraise the changes brought about through development work.

This year the State's investigation has laid the ground work for establishing trend areas. Coverage was only superficial in most areas through necessity, with emphasis being placed on the northeast corner of the State. At present it is possible to arbitrarily divide the State into four geographical units (see map). These units are more or less separated by arid regions containing water areas on a very limited scale. Other geographical units exist, but their value as production areas is slight, as they are small and scattered.

The units were chosen on the basis of the most abundant type of habitat. Unit I is predominately reservoirs and some irrigated meadow land; Unit II is mostly river-bottom (irrigated meadow) and reservoir, but includes the Ruby Marshes, a key area. Unit III, is made up of lakes and meadow land, and Unit IV, irrigated farm land and marsh; and contains the Stillwater marsh which is a key area. Trend areas have or will be established in each of the four units.

Investigations were carried on from June 1, through August 31, 1950, in Unit II. This area comprises the head waters of the Humboldt River drainage, and was selected because the habitat was relatively concentrated, enabling coverage of more area in a given time. Work in Unit IV, Stillwater Wildlife Management Area, was conducted May 15, through August 7, 1950.

Methods

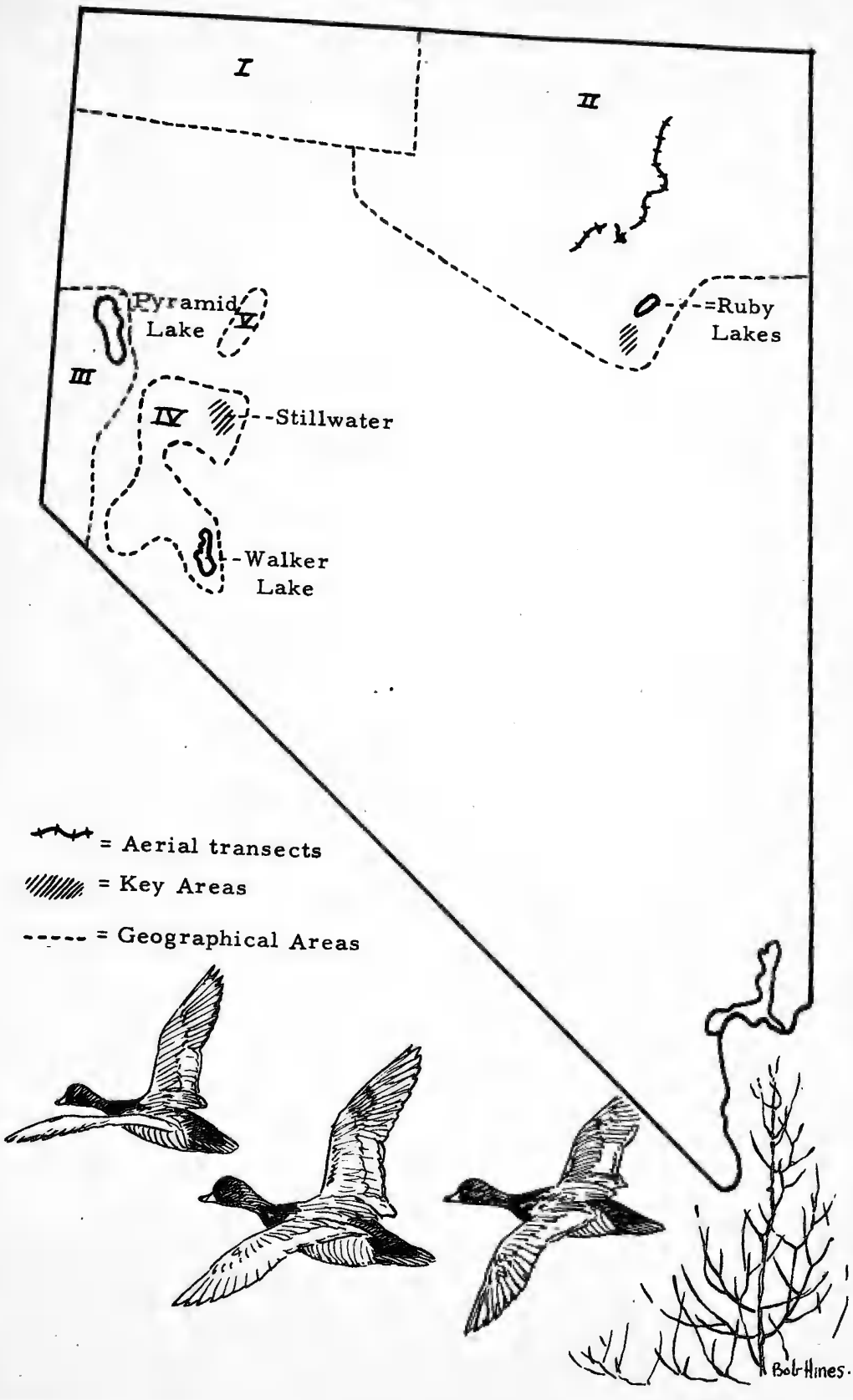
River and Reservoir Survey

Aerial transects were established (see map) on the tributaries and forks of the Humboldt River, with the limits of each one at definite land marks. The plane used was a Cessna 140 and the pilot observed whenever possible. The observer has access to only one side of the plane and it was found advisable to fly a section of the river covering a third or half of the habitat and then turn with the observer still in a position to see, and return to the start of that section. This required flying over the wider sections of the river bottom two or more times which resulted in a more complete coverage. Very few birds were moved by the activity of the plane, but many broods did seek cover as the plane flew over them, making species identification difficult.

****

* Information was contributed by LeRoy Giles and David Marshall, Biologists, U. S. Fish and Wildlife Service personnel, (S.W.M.A.) and Refuge personnel at Ruby Lakes, N.W.R. Pilots were Joe Rabb of Nevada Fish and Game Commission, Big Game Technician and Virgil Hart, Student Assistant. Earl Dudley, State Game Warden aided in ground work.

Principal Waterfowl Breeding Regions - Nevada



Blank Page Digitally Inserted

Ten reservoirs were chosen as trend areas, and were covered by boat and on foot. The reservoirs varied in size from 1 to 1,520 acres and constituted the best reservoir available for waterfowl.

The topography of the area covered is characterized by valleys 5,000 feet in elevation and above. The rivers and larger streams meander through irrigated meadow land with the main channels bordered by willows. Many ponds and oxbows contain water early in the season and become progressively drier through August. The bottom lands are used primarily for production of native hay.

The reservoirs are primarily for irrigation purposes, but are also accessible for stock watering and provide grazing around their perimeter. Most of the reservoirs occur in the sagebrush belt, one is in a grease-wood association.

Marsh Survey

The techniques used at Stillwater Wildlife Management Area this year differed from the study last year so that the data are not comparable and therefore are not included. This year a detailed cover type map was used to locate through one observation only, though in many instances additional observations were possible. It is estimated that close to 75 percent of the total breeding pairs were recorded on the cover type map.

Information derived from the completed map was: An estimate of the breeding population and determination of what part of the marsh was productive and what part non-productive (50 percent was found to be non-productive for ducks and geese.)

Weather and Water Conditions

Light snow fell the first week in June in northeast Nevada, but was of short duration. Spring was considered late and mild, and the water supply was normal to above normal. Migration reached its peak for the Stillwater Wildlife Management Area the latter part of February, and the peak recorded for the Ruby Marshes was about April 15. By the last part of August water in the rivers was confined to the main channels and some of the larger oxbows and ponds behind small diversion dams; which resulted in concentrating the broods. In general the water levels in the reservoirs dropped; however, all reservoirs were classed as permanent water. Weather and water throughout the areas covered were considered good from the standpoint of production, though water conditions continued lower at Ruby Lake as for the past four years (approximately .15 feet per year) limiting nesting to the south end of the area.

Breeding Stock Trends

River and Reservoir Survey

By the first part of June many of the breeding pairs had separated. The lateness of the census together with the type of cover present resulted in low counts on breeding pairs, and an inclusion of a great number of unidentified species.

Table 1. -- Species Composition - Aerial Transects

Species	No. Seen	Percent Abundance	Species Per Sq. Mi..
Mallard	102	40.6	4.2
Pintail	64	25.5	2.64
Cinnamon teal	64	25.5	2.64
Gadwall	13	5.2	.54
Redhead	2	.8	--
Green-winged teal	2	.8	--
Merganser	4	1.6	--
Unidentified	239		
Total	490		

There are approximately 550 square miles of irrigated land, (meadow, cultivated crops and pasture) in geographical Unit 11. Forty-seven square miles were flown, resulting in an 8.62 percent coverage of the total habitat, and a ratio of 10.4 ducks per square mile.

Records obtained of the breeding population on the reservoirs were more complete as to species, pairs, and single males and females, than was possible for the aerial transects. The lateness of the count was again evident in that few pairs of the early nesting species were seen when compared with their production.

Table 2. -- Breeding Population - Reservoirs

Species	Pairs	Single Female	Single Male	Pairs Sq. Mi.	Female Sq. Mi.	Male Sq. Mi.	Total	Percent Total
Mallard	8	40	64	1.76	8.8	14.1	120	9.56
Pintail	8	44	91	1.76	9.7	20.1	151	12.0
Gadwall	94	13	34	20.6	2.86	7.5	235	18.7
Cinnamon teal	24	6	60	5.3	1.32	13.2	114	9.1
G-w. teal	5	2	67	1.1	.44	14.7	79	6.3
Baldpate	4	1	6	.88	.22	1.32	15	1.19
B-w. teal	4	-	1	.88	-	.22	9	.72
Shoveler	2	-	15	.44	-	3.3	19	1.52
Redhead	58	6	17	12.8	1.32	3.74	139	11.1
Lesser scaup	13	1	39	2.86	.22	8.6	66	5.26
Ruddy	23	10	21	4.4	2.2	4.63	77	6.14
Coot	-	-	-	-	-	-	230	18.3
Totals	243	123	415	53.6	27.2	91.5	1,254	

The aggregate of the ten reservoirs, ranging in size from one to 1,520 acres, was 4.54 square miles which gave a count of 53.6 pairs per square mile. As stated before, although selected at random, the reservoirs represent some of the largest and probably best for waterfowl in this unit. The ratio of reservoirs covered to reservoirs available in this unit is not known as new ones are being built every year by individuals for stock watering and irrigation.

Marsh Survey

Of the total habitat available in Unit 1V only the marsh and lakes of Stillwater Wildlife Management Area were investigated. On the basis of total marsh and lake area, 21.18 square miles, the Stillwater marsh and the Indian Lakes had a breeding population of 64.5 pairs per square mile.

Table 3. -- Nesting Pairs - Stillwater Wildlife Management Area

Species	Stillwater	Indian Lakes	Total	% Total
Mallard	70	30	100	3.5
Gadwall	125	75	200	7.0
Pintail	12	8	20	-
Baldpate	2	8	10	-
Cinnamon teal	320	20	340	12.0
Shoveler	10	5	15	-
Redhead	640	10	650	23.2
Ruddy	30	-	30	1.0
Canada goose	15	-	15	-
Coot	1490	10	1500	53.6
Totals	2714	166	2880	

Brood Success

River and Reservoir Survey

Since species identification was not possible on enough broods to be significant, all broods seen along the aerial transects were grouped.

Table 4. Aerial Brood Count

Transect	Date	Broods	Young	Average
Mary's River	6/15	4	29	7.24
	7/20	19	133	7.0
Deeth - Elburz	6/15	2	11	5.5
	6/29	47	259	5.5
	8/16	39	201	5.15
Elko - Carlin Canyon	6/15	1	6	6.0
	7/29	27	152	5.64
	8/16	33	166	5.03
South Fork	6/29	10	35	3.5
	7/29	30	213	7.1
	8/16	29	181	6.24
Lamoille	7/29	5	24	4.8
	8/16	3	14	4.66
Totals		249	1,424	5.72

The transects were reflown later to determine water conditions and the distribution of the broods. The recounts show a decline in the average per brood, and as the broods became concentrated only those groups that appeared as broods were counted. The number of broods per square mile was 5.26 with an average brood size of 5.72.

Table 5. -- Brood Counts - Reservoirs

Species	Class 1			Class 11			Class 111			Total		
	Broods	Young	Av.	Broods	Young	Av.	Broods	Young	Av.	Broods	Young	Av.
Mallard	12	75	6.25	31	187	6.04	33	189	5.73	76	451	5.94
Pintail	5	29	5.8	24	104	4.34	27	157	5.82	56	290	5.18
Gadwall	15	88	5.86	49	353	7.2	3	13	4.33	67	454	6.78
Cinnamon teal	2	10	5.0	12	73	6.08	9	56	6.23	23	139	6.04
Green-winged teal	2	14	7.0	7	39	5.57	15	94	6.26	24	147	6.14
Shoveler	-	-	-	4	26	6.5	2	13	6.5	6	39	6.5
Blue-winged teal	1	12	12.0	1	7	7.0	-	-	-	2	19	9.5
Redhead	4	27	6.75	7	43	6.15	3	16	5.34	14	86	6.14
Lesser scaup	4	45	11.24	6	81	13.5	-	-	-	10	126	12.6
Baldpate	-	-	-	6	43	7.18	-	-	-	6	43	7.18
Ruddy	1	4	4.0	4	17	4.25	-	-	-	5	21	4.2
Total	46	304	6.61	151	973	6.45	92	538	5.85	289	1,815	6.28
Broods per Sq. Mi.	10.1			33.2			20.3			63.5		

A total of 289 broods of all classes give a ratio of 63.5 broods per square mile of reservoir habitat. There is a mortality of 11.5 percent between the 6.61 average for all Class 1 broods and the 5.85 average for all Class 111 broods.

The high ratio of ducks, pairs, and broods per acre as determined from this year's study indicates the value of this type of habitat in this Unit, and may point the way to management through improvement of reservoirs and smaller impoundments for waterfowl.

Marsh Survey

On the Stillwater Wildlife Management Area a total of 247 broods of all classes were observed with an average of 5.54 for all broods and a density of 11.7 broods per square mile. (Including 50 percent non-productive marsh.)

Table 6. -- Brood Counts - Stillwater

Species	Class I			Class II			Class III			Total		
	Broods	Young	Av.	Broods	Young	Av.	Broods	Young	Av.	Broods	Young	Av.
Mallard	5	41	8.2	7	45	6.6	6	35	5.8	18	121	6.73
Gadwall	16	142	8.9	23	153	6.7	1	8	8.0	40	303	7.57
Baldpate	-	-	-	4	30	7.5	-	-	-	4	30	7.5
Pintail	1	4	4.0	1	5	5.0	2	13	6.5	4	22	5.5
Cinnamon teal	6	27	4.5	9	59	6.6	7	36	5.1	22	122	5.54
Shoveler	1	2	2.0	1	5	5.0	-	-	-	2	7	3.5
Redhead	75	382	5.1	64	282	4.4	11	58	5.3	150	722	4.8
Ruddy	104	26	6.5	1	2	-	2	10	5.0	7	38	5.44
Total	208	624	5.8	110	581	5.3	29	160	5.5	247	1,365	5.5

Table 7. -- Brood Counts - Ruby Lake

Species	Total Broods	Total Young	Average
Mallard	74	350	4.72
Gadwall	29	186	6.41
Cinnamon teal	132	702	5.31
Shoveler	34	141	4.14
Redhead	135	694	5.14
Canvasback	122	587	4.73
Ring-necked duck	12	58	4.83
Lesser scaup	5	24	4.80
Total	618	3,082	5.0
Coot	336	793	2.34
Trumpeter swan	0	0	0
Broods per Sq. Mi.	68.2 excluding coots		

Canada Goose Production

Production figures are on hand for the 1949 season from Unit 1, but to date no information has been received for this year. The breeding population of geese was slightly down this year at Ruby Lakes, no comparative brood data are available.

Table 8. -- Canada Goose Broods

Area	Class I			Class II			Class III			Total		
	Broods	Young	Av.	Broods	Young	Av.	Broods	Young	Av.	Broods	Young	Av.
Stillwater	6	23	3.84	-	-	-	3	7	2.34	9	30	3.34
Elko-Carlin Transect	-	-	-	-	-	-	4	23	5.74	4	23	5.74
Jiggs Reservoir	1	5	5.0	9	49	5.45	9	70	7.78	19	124	6.54
Ruby Lakes	-	-	-	-	-	-	-	-	-	61	245	4.01

Summary

In considering the information available, the 1950 breeding season appears to be slightly better than last year, due to better water conditions across the northern and western parts of the State.

Thirteen species of ducks were recorded as nesting in Nevada. Species in order of production according to number of broods and young seen for the river and reservoir survey here: Mallard, gadwall, pintail, green-winged teal, cinnamon teal, redhead, lesser scaup, baldpate, shoveler, ruddy duck, and blue-winged teal.

For the marsh survey the order by species is redhead, cinnamon teal, canvasback, gadwall, mallard, shoveler, ring-necked duck, ruddy duck, lesser scaup, baldpate, and pintail.

The peak in numbers of broods seen occurred during the latter part of July on the river and reservoir survey.

The first year's survey indicates 10.4 ducks per square mile for river transects: 53.6 pairs per square mile of reservoir habitat sampled, and 64.5 pairs per square mile of marsh habitat (Stillwater Wildlife Management Area.)

Broods per square mile were found to be 5.26 for the river transects, 63.5 for reservoir habitat and 68.2 for Ruby Marshes with 11.7 for Stillwater Marshes.

Banding

Banding was carried on from August 27 to September 10, and October 1 to 10, at Stillwater Wildlife Management Area.

Summary of Summer Banding

Species	Loc. Male	Loc. Female	A M	I M	A F	I F	Total
Pintail	-	-	108	43	72	41	264
Mallard	2	2	26	4	11	5	50
Redhead	8	3	-	-	-	1	12
Gadwall	-	-	-	-	-	1	1
Cinnamon teal	-	-	-	-	-	1	1
							329

WATERFOWL BREEDING GROUND SURVEY IN IDAHO, 1950

Robert L. Salter

Idaho has long been considered an important contributor to the number of waterfowl produced within the United States. Until recently, however, no concerted effort has been made to evaluate the waterfowl breeding in Idaho on a state-wide basis. Previous work has been limited to casual observations and reports made by local Conservation Officers, or restricted surveys on one or two areas taken by persons working primarily outside the State.

In an attempt to learn something more concrete about Idaho's waterfowl production, two investigations have been initiated. For the past two years an intensive research project has been carried out by graduate assistants of the Idaho Cooperative Wildlife Research Unit. This study was designed to determine the waterfowl production on Gray's Lake in southeastern Idaho. The results are presented elsewhere in this report by Bizeau and Steel. Also, this summer an attempt was made by the author to locate and become familiar with the important breeding areas of the State. All those areas believed to be the most important were visited at least once. Due to time, personnel, and equipment limitations it was not possible to conduct standardized transects on any great number of the areas. The familiarity gained, however, will be valuable when planning for future work. Car, boat, foot, and airplane travel was utilized to cover the areas. It was discovered that the airplane was feasible in certain areas only when used to count geese. Some of the best areas lie at 5-6 thousand feet altitude, and in order to maintain a safety factor it was necessary to fly the plane too high to enable the observer to census ducks accurately in the dense, emergent vegetation common in most localities.

Weather and Water

In most areas the water supply was adequate throughout the nesting and brooding season. An above-normal snow pack melted quite slowly and most streams maintained their flow, while reservoirs had a good supply throughout the season. The northern portion of the State experienced some serious spring floods, but this is almost a yearly occurrence. Summer wind, rain, and hail storms were no more serious or widespread than usual.

Goose Nesting Study

Since most of the work done was of a first year and exploratory nature, it is not felt that it warrants inclusion here until future work permits comparisons to be drawn. It was possible, however, to gather comparable goose nesting data from three areas of the State. Two of the areas were on islands in the Snake River and one on islands in Blackfoot Reservoir in Caribou County. Results are shown in Table 1.

The Homedale area consists of 26 miles of river upstream from Homedale in Owyhee County. All suitable islands were searched for nests. Nest hunting was done on April 18. G. Hortin Jensen, Flyway Biologist, and F. Sheldon Dart, Refuge Manager, Deer Flat National Wildlife Refuge, assisted in the search. Dart assisted in the re-check taken on May 4. Peak of hatch on this area was estimated to be the week of April 23-29.

The Glenns Ferry area consists of approximately 25 miles of river downstream from Glenns Ferry in Elmore county. All suitable islands were searched for nests by the above crew on April 19. Assistance in the re-check on May 5 was given by Alvard Kiler, Assistant Bird Biologist, Idaho Fish and Game Department. The

low hatching success ratio was attributed mainly to mammalian predation. Peak of hatch was estimated to be the week of April 23-29.

A search of four small islands of the best nesting habitat in Blackfoot Reservoir in Caribou County was made on May 19 with the assistance of Bizeau and Steel. The area was re-checked on June 20. The peak of hatch was estimated to occur during the week of May 21-27, almost one month later than in the other two areas. The Reservoir is approximately 3,500 feet higher than the two river areas. The average hatch for this area this year is considerably higher than that recorded previously by Jensen and Nelson in Special Scientific Report: Wildlife No. 2, U.S.D.I. and Canada Department of Mines and Resources.

Banding

In cooperation with Hortin Jensen, a successful Canada goose banding operation was carried out on June 28 at Blackfoot Reservoir. The geese were slowly driven by boats into a large wing trap.

A limited amount of early fall banding was done at North Lake Refuge in Jefferson County. Baited traps were used here. The banding results at both areas are shown in Table 2.

Table 1. -- A Comparison of Canada Goose Nesting Success at Three Areas in Idaho, 1950

	Homedale	Glenns Ferry	Blackfoot Reservoir
No. Nests Found	26	26	46
No. Nest Histories Completed	22	26	42
No. Successful Nests	15 (68%)	10 (38%)	32 (76%)
No. Nests Deserted or Destroyed	7 (32%)	16 (62%)	10 (24%)
Av. Clutch Successful Nest	5.8	5.2	4.9
Av. Hatch Successful Nest	4.5	5.0	4.5

Table 2. -- Idaho Banding Data, Summer 1950

BR - Blackfoot Reservoir
NLR - North Lake Refuge

Species and Area	Male		Female		Total
	Ad.	Imm.	Ad.	Imm.	
Canada goose BR	188	8	225	5	426
Mallard NLR	52	39	20	44	155
Pintail NLR	5	11	12	11	39
G-w. teal NLR		3	1	1	5
B-w./Cinn. teal NLR		1		3	4
B-w. teal NLR		1			1
Baldpate NLR		1			1

WATERFOWL PRODUCTION AT GRAY'S LAKE, IDAHO, * 1950

Elwood G. Bizeau and Paul E. Steel

Introduction

Gray's Lake is a 22,000 acre high altitude marsh located in southeastern Idaho. It is characterized by extensive stands of dense, emergent vegetation (mainly Scirpus acutus) which covers 90 percent of the marsh proper at high water stage.

A waterfowl production investigation involving population, nesting and brood studies was begun at the lake in May, 1949, and will be continued through the 1951 breeding season. This investigation is a part of the research program of the Idaho Cooperative Wildlife Research Unit.

The 1949 studies were conducted by Elwood G. Bizeau, research fellow, with the part-time aid of George Lea, student assistant. The 1950 population and nesting studies were jointly carried on by Bizeau and Paul E. Steel, research fellow. Brood studies and banding operations during 1950 were conducted by Steel.

Methods Used in Sampling

Population Counts

Population figures were obtained from periodic counts at established counting points around the lake margin and from foot and boat patrols repeated over fixed routes.

Goose Nest Production

Total nest estimates for geese were obtained from a full coverage of the accessible open water areas of the marsh by boat and by search of adjacent shore on foot. To get an approximation of the number of goose nests not found on the marsh and adjoining lands, thorough rechecks were made of selected areas previously searched. The number of nests found on recheck searches was then used as an indicator of the number of nests normally not found on the remainder of the lake.

Duck Nest Production

Nest density estimates for land nests were obtained from a number of small block areas selected to include samples of all the main cover types existing near the marsh. These areas were worked repeatedly throughout the nesting season with the aid of a dog and by rope-dragging.

Nest density estimates for over-water nests were obtained from random samples of vegetation edge established throughout the accessible open-water areas of the marsh and worked repeatedly by boat during the nesting season.

Brood Counts

Juvenile mortality was measured by conducting brood counts throughout the brood season, repeatedly visiting each area of the lake at intervals. Counts were made from a powered boat, from a canoe and from foot patrols along the lake margin. Only broods accompanied by brood females were counted.

* A contribution of the Idaho Cooperative Wildlife Research Unit.

Weather and Water Conditions

The spring thaw at the lake was 10 to 14 days later during 1950 than in 1949. The later arrival of spring at this high altitude (6, 400 feet) apparently did not alter the time pattern of nest establishment for Canada geese. In 1950, the peak of nest establishment for geese occurred April 16-20 when only a small part of the lake was ice-free. For comparison, brood counts and nest hatch dates on geese in 1949 showed that the peak of nest establishment occurred April 19-24.

Nest records and brood observations on ducks indicated that the peak of nest establishment occurred from one to two weeks later in 1950 for the early nesting duck species at Gray's Lake (mallard, pintail, canvasback and redhead) as compared to 1949.

Aside from the chronic lack of interspersion of water and vegetation on Gray's Lake marsh, water conditions for nesting were excellent during the 1950 season. Run-off from the small creek watersheds feeding the lake was gradual and there was no evidence of loss of waterfowl nests from flooding. Comparison of gauge measurements taken throughout the nesting seasons of 1949 and 1950 shows that the lake level remained approximately one-half foot higher throughout the 1950 nesting season than it was in 1949.

The lake level dropped 1.72 feet from May 1 to September 1, 1950, with consequent severe shrinkage of the open water areas available to broods. Water records for previous years indicate that this marked water loss occurs annually at the lake. By August, 1950, most of the broods were concentrated in the few areas of the marsh which held water throughout the summer.

Breeding Population Trends

Waterfowl Counts

Population counts conducted during the later part of May were believed to represent the breeding population of ducks at the lake, since the peak of migration for all species had passed by mid-May, 1950. Table 1 presents the species composition of the breeding population of ducks for 1949 and 1950.

A marked decrease in percent composition occurred in only one species, the mallard. Pintails show a definite increase in composition. Mallards and pintails together made up roughly one-half of the breeding population of ducks in both years.

From ground counts, total breeding populations of 15, 000 ducks for 1949 and 12, 000 for 1950 were estimated; these estimates indicate a decline of one-fifth in duck numbers between the 1949 and 1950 seasons. This decline indicated by population estimates is apparently corroborated by the results obtained in sampling for duck nest density on the marsh (Table 2.) and in brood counts.

In 1950, April counts indicated a total of approximately 1, 000 Canada geese at the lake. From nest data accumulated during the 1950 season, it was calculated that 600 of the 1950 goose population were breeding birds. Groups of (apparently) non-breeding geese were observed around the edges of the marsh throughout the goose-nesting season. Due to the late start of field studies during 1949, a reliable estimate of the breeding population of geese present during 1949 is not available to give trend.

Table 1. -- Species Composition of the Breeding Population of Ducks, Gray's Lake, Idaho, May, 1949 and 1950

Species Order of Abundance	Percent Composition 1949	1950
Mallard	31	24
Pintail	19	23
Canvasback	11	9
Redhead	10	11
Teal, Cinnamon	9	8
Scaup, Lesser	8	9
Ruddy Duck	5	7
Gadwall	2	3
Shoveler	2	3
Teal, Blue-winged	2	2
Teal, Green-winged	1	1
Ring-necked Duck	--	Trace
Buffleh̲ead	Trace	Trace
Baldpate	Trace	Trace

Success of the Season

Goose Production

During 1950, 204 goose nests were found at the lake. It was estimated by means of recheck searches over areas previously covered that approximately two-thirds of the goose nests at the lake were found by the investigators; thus, a total of approximately 300 goose nests were estimated for Gray's Lake during the 1950 season. Nest success for geese was 75 percent and an average hatch of 4.4 goslings per successful nest was achieved (see Table 3). Applying the formula, total nests x nest success x average hatch, a gosling production of approximately 1,000 was calculated for Gray's Lake during 1950, disregarding the influence of possible renesting.

Duck Nest Production

On 525 acres of land terrain sampled for duck nests during 1950, a total of 68 nests were found, giving a nest density of 13 nests per hundred habitat acres of land. Since a reliable nest density figure for land nests was not obtained during the 1949 season, no comparison between seasons is possible.

For ducks nesting over water (marsh samples), twenty-four miles of vegetation edge sampled during 1950 produced a nest density of 2.1 nests per mile of edge, or 39 nests per hundred habitat acres. Table 2 presents the nest density results for over-water nests by species. In 1949, a total of 11.4 miles of vegetation edge was sampled and a nest density obtained of 2.5 nests per mile of edge, or 47 nests per hundred habitat acres.

From the following data on over-water nests, it appears that the trend of nesting on the marsh between 1949 and 1950 is downward, by about 17 percent, for all duck species combined. This decline in nest abundance may be a true reflection of the estimated one-fifth decline in the Gray's Lake breeding population which apparently occurred between the 1949 and 1950 seasons, as indicated by May population estimates.

Table 2. -- Duck Nest Density on Marsh Samples, Gray's Lake, Idaho, 1950

Species	Total Nests Found	Nests Per Mile of Edge	Nests Per 100 Habitat Acres 1/
Diving Ducks			
Canvasback	7	0.29	5.4
Redhead	20	0.83	15.4
Ruddy Duck	3	0.12	2.3
Scaup, Lesser	2	0.08	1.5
Sub-totals	32	1.32	24.6
Dabbler Ducks			
Mallard	15	0.62	11.5
Teal, B-w. &/or Cinn.	3	0.12	2.3
Gadwall	1	0.04	0.8
Sub-totals	19	0.78	14.6
All Species	51	2.1	39.2

1/ Habitat acres for marsh nesting ducks = all edges of emergent vegetation to 15 yards in depth from the open water edge.

Hatching Success

During the 1950 season, nest history records were completed on 187 Canada goose nests and on 213 duck nests of 10 species. Table 3 summarizes the duck and goose nesting data obtained during both the 1949 and 1950 seasons, for comparative purposes. In some species only a few nests were terminated; information on nests of these species is included for its face value. Average hatch figures are computed only for those species where 10 or more nests were successful.

Comparison of nest and egg data between the 1949 and 1950 seasons reveals that a much lower egg success (12 percent less) occurred in the Canada goose for 1950. In the ducks, a lower egg success (5 percent less) was recorded for 1950 as compared to 1949 for all duck species combined. Particularly high nest and egg successes were found in the redhead for 1950.

An interesting and ecologically important fact relating to goose nesting at the lake was that 81 percent of all goose nests found during the 1950 season were situated on muskrat houses.

Juvenile Mortality

Not only were less broods observed in 1950 than in 1949, but the average size was generally smaller in all three age classes. Several reasons may have been responsible for the fewer broods observed: 1) the known smaller breeding population, 2) the rank growth of emergent vegetation in areas which last year remained open water until after the peak of the brood season, and 3) the apparent earlier desertion of broods by diver females, possibly reflecting the influence of the later nesting season in 1950.

Table 4 records the brood data for the past two years with the average hatch per successful nest given for those species with sufficient nest data. In 1949, 991 brood counts were made as compared to only 490 in 1950. Because of the brood counting

Table 3. — Summary of Nest and Egg Data for all Nests under Observation, Gray's Lake, Idaho, 1949 and 1950

Species	NESTS						EGGS							
	Total Nests Terminated		Nests Successful		Percentage Nest Success		Total Eggs Terminated		Eggs Hatched		Percentage Egg Success		Average Clutch	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
Canvasback	19	20	13	12	68	60	152	170	101	71	66	42	8.0	8.2
Redhead	24	49	16	44	67	90	204	457	120	318	59	70	8.9	9.3
Ruddy duck	12	5	7	2	58	40	90	34	49	9	54	26	8.2	6.8
Scaup, Lesser	6	11	5	7	83	64	55	94	49	54	89	57	9.2	8.5
Mallard	21	57	16	41	76	72	168	462	122	288	73	62	8.0	8.1
Pintail	24	39	16	26	67	67	178	296	114	181	64	61	7.7	7.6
Teal, B-w./Cinn.	18	25	10	13	56	52	145	270	74	132	51	49	8.6	10.6
Gadwall	4	3	4	1	100	33	35	28	32	10	91	36	8.8	9.3
Shoveler	-	4	-	3	-	75	-	35	-	23	-	66	-	8.7
All Ducks	128	213	87	149	68	70	1027	1846	661	1086	64	59	8.0	8.7
Goose, Canada	36	187	29	140	81	75	166	968	124	612	75	63	4.3	4.4
Crane, Sandhill	12	44	11	40	92	91	24	85	20	72	83	85	2.0	1.9

methods used and the abundant brood cover available, more broods were accurately observed for divers than for dabblers. An analysis of total broods seen per species cannot be used as an index to production.

Over the two years 80 juvenile ducks were found dead. Unknown causes accounted for 35 (44 percent), hawk kills, 28 (25 percent) and mink kills, 17 (21 percent). While in only five instances was a marsh hawk actually flushed from a fresh kill, this abundant species was apparently the chief avian predator. It was the only hawk regularly seen hunting over the marsh.

Banding Record

Before the inauguration of this study there was apparently no previous banding done at Gray's Lake. Of the 6 recoveries of the 85 ducks banded last summer 3 were outside of Idaho; one each from California, New Mexico, and Louisiana.

Banding commenced on August 27 and ceased on September 11, this year. The water trap used was constructed out of one-inch mesh chicken wire situated in shallow water averaging a foot in depth with the holding boxes on the shore. Trap materials, bait, and other assistance during the banding operation were furnished by the Idaho Fish and Game Department through Robert L. Salter, State Waterfowl Biologist.

Table 4. -- Average Hatch and Record of Brood Size Averages by Age Class at Gray's Lake, 1949 and 1950

Species	Year	Av. Hatch Per Successful Nest	Class 1	Class 11	Class 111	No. Broods
Mallard	1949	7.6	7.6 (18)*	5.2 (13)	5.0 (8)	39
	1950	7.0	6.5 (4)	5.3 (4)		10
Pintail	1949	7.1	7.3 (9)	7.1 (8)	6.7 (13)	30
	1950	7.0	5.3 (3)	7.0 (1)	6.0 (1)	5
Gadwall	1949		7.9 (27)	7.2 (19)		46
	1950		7.8 (19)	3.0 (1)		20
Baldpate	1949					
	1950		5.0 (4)			4
Shoveler	1949					
	1950			8.0 (1)	7.0 (1)	2
B-w/Cinn. teal	1949	7.4	8.9 (16)	7.5 (11)	5.7 (6)	33
	1950	10.2	4.1 (7)	5.4 (5)	6.0 (1)	13
G-w. teal	1949					
	1950		2.0 (1)			1
Canvasback	1949	7.8	7.2 (50)	5.9 (97)	5.0 (72)	219
	1950	5.9	5.8 (46)	5.4 (49)	5.4 (30)	125
Redhead	1949	7.5	7.1 (58)	6.1 (63)	5.5 (41)	162
	1950	7.2	5.9 (56)	6.5 (23)	6.3 (4)	83
Lesser scaup	1949		7.1 (81)	6.2 (94)		175
	1950		6.5 (64)	5.4 (18)		82
Ruddy duck	1949		6.3 (130)	5.2 (78)		208
	1950		5.8 (98)	4.8 (6)		104
Canada geese	1949		4.4 (41)	4.1 (20)	4.1 (18)	79
	1950		4.5 (29)	2.5 (2)	3.7 (10)	41

*Figures in parenthesis are numbers of brood counts from which brood size figure was computed.

A total of 458 ducks were banded, with mallards comprising most of the total. Population counts revealed this species to be the most common during the banding period. Table 5 is a compilation of ducks banded by species, age, and sex.

Table 5. -- Banding Record at Gray's Lake, Idaho, Summer of 1950

Species	Sex	Adult	Local	Total
Mallard	M	123	42	417
	F	178	74	
Pintail	M	7	6	21
	F	5	3	
B-w./Cinn. Teal	M		4	9
	F		5	
G-w. Teal	M	1	2	4
	F	1		
Gadwall	M			2
	F		2	
Redhead	M		1	2
	F		1	
Canvasback	M			1
	F		1	
Coot			2	2
Total		315	143	458

Summary

1. The spring thaw occurred 10 to 14 days later at Gray's Lake in 1950 than in 1949. Water conditions were considered to be excellent for nesting.

2. Duck counts indicated a decline of one-fifth in the breeding population of ducks from 1949 to 1950. The mallard population suffered the highest numerical loss. Mallards and pintails together made up approximately one-half of the total breeding population of ducks at the lake in both 1949 and 1950.

3. Canada goose production at the lake in 1950 was calculated to be approximately 1,000 goslings.

4. On the basis of marsh samples, the trend of nest abundance on the lake was downward between the 1949 and 1950 seasons. A 17 percent lower nest density per hundred habitat acres of marsh was obtained in 1950 as compared to 1949.

5. Nest and egg success data for 1950 was presented for 187 Canada goose nests and 213 duck nests. A lower egg success was recorded for both Canada geese and ducks in 1950 as compared to the previous season.

6. In 1949, 991 brood counts were made and only 490 in 1950. The average brood size was generally lower for all species of ducks. Other than for unknown causes, the mink and marsh hawk were the major decimating factors observed.

7. Of the 458 ducks banded this summer 417 were mallards.

WATERFOWL BREEDING GROUND SURVEYS IN UTAH - 1950

Noland F. Nelson

Aerial Transects

The Utah State Fish and Game Department initiated an aerial survey of the breeding grounds of northern Utah in 1950 in an effort to more accurately determine trends in the breeding population. Only a limited number of miles of transect were flown in 1950 but it is hoped to extend this coverage in 1951. These same transects will be flown on the same lines each year by using well-defined landmarks. No attempt was made to break the count down by species because sudden large concentrations of ducks were encountered. The breakdown by species was obtained from ground counts made on refuges which were along the flight lines.

A total of 164 miles were flown in Weber, Box Elder, and Cache Counties. No flights were made on the breeding areas south of Ogden Bay, but these areas will be flown next year. A total of 1,070 ducks were counted along eighty-two miles flown in Weber and South Box Elder Counties. This would represent an average of 51 birds per square mile in this area. A total of 178 birds were counted along (82) miles flown in Cache and northern Box Elder Counties. This would represent an average of 2.1 birds per square mile in this area.

Ground Counts

Counts were made of breeding pairs on three State refuge areas by driving a car along the dike lines. All birds which could be readily identified were counted. The percent of the area covered was tabulated and the count applied to the whole of the refuge area. A comparison of the count with that of 1949 showed a marked decline on all areas (see Table 1.)

Table 1. -- Total Breeding Pairs of Three State Refuges from Dike Line Census -- 1949 and 1950

	Ogden Bay		Farmington Bay		Public Shooting Grounds	
Species	1949	1950	1949	1950	1949	1950
Canada goose	202	115	65	65	41	28
Mallard	520	245	111	105	160	135
Gadwall	735	255	43	83	98	75
Pintail	412	230	82	55	213	65
Cinnamon teal	674	350	183	175	169	180
Redhead	872	375	327	150	526	245
Shoveler	312	175	38	47	47	25
Green-winged teal	-	2	-	-	-	-
Blue-winged teal	-	8	-	2	-	5
Ruddy	18	15	10	7	-	-
Baldpate	1	1	-	-	-	-
Total	3746	1771	859	689	1254	758

Nesting Studies

Nesting studies at Ogden Bay showed a large increase in the number of eggs taken by predator. The predation by the California gull increased from 11.5 percent of all eggs in 1949 to 22.1 percent of all eggs in 1950. The skunk predation of 4.8 percent

of all eggs was double that of last year. This increase in predation was, no doubt, due in part to the inclement weather and the delayed growth of nesting cover.

Table 2. -- Fate of Eggs in Nests Under Observation at Ogden Bay - 1950

Species	Total Eggs	Hatched	Deserted	Left in Nest	DESTROYED			
					Flooded	Gulls	Skunk	Unknown
Mallard	308*	158	17	13	4	103	13	--
Gadwall	301	233	6	13	--	27	22	--
Cinn. teal	629	312	83	35	44	123	9	23
Pintail	107	65	2	17	--	23	--	--
Redhead	204	71	14	36	--	60	21	2
Shoveler	81	39	--	1	--	27	14	--
G-w. teal	10	10	--	--	--	--	--	--
Total	1,640	888	122	115	48	363	79	25
Percent		54.2	7.4	7.0	2.9	22.1	4.8	1.6

* This table includes redhead eggs layed in other birds' nests.

Table 3. -- Nesting Success at Ogden Bay Refuge - 1950

Species	Nests	Not Successful		Successful		Average Number of Eggs	
		No.	Percent	No.	Percent	Layed	Hatched
Mallard	37	16	43.2	21	56.8	8.9*	7.5
Gadwall	31	7	22.6	24	77.4	10.3	9.7
Cinn. teal	67	29	43.3	38	56.7	9.8	8.2
Pintail	14	4	28.6	10	71.4	7.7	6.5
Redhead	21	12	57.1	9	42.9	11.9	7.9
Shoveler	10	5	50.0	5	50.0	8.0	7.8
G-w. teal	1	-	--	1	100.0	10.0	10.0
Total	181	73	40.3	108	59.7	9.6	8.2

* This table includes redhead eggs layed in other birds' nests.

The average number of eggs per nest declined from 11.6 for all species in 1949 to 9.6 for all species in 1950. This decline was brought about by a large number of birds which renested after failure during the inclement weather in the early spring. The second clutch of eggs layed was smaller than the first. The number of eggs which hatched in the nests remained the same as the year before so the initial brood sizes should have remained the same as last year.

Conclusions

The aerial surveys had no previous data with which to make comparison but the counts on State refuges showed a marked decline in the breeding population for these areas. This decline was also noted in the reduced number of broods and young ducks on the areas throughout the summer. Reports from other areas in the State indicate there was a decline but not so marked as on the State areas.

WATERFOWL BREEDING GROUND SURVEY IN MONTANA - 1950

Wynn G. Freeman and Gerald Salinas 1/

During the spring and summer of 1950 the Montana Fish and Game Department continued its program of waterfowl investigations. The evaluation of the important waterfowl breeding grounds of Montana has been in progress for two years. These investigations are made to satisfy our recognized need for a current waterfowl inventory and a measure of production as a prerequisite to any successful management of waterfowl on the local and the continental levels.

After completion of the early spring aerial census, additional breeding ground investigations were undertaken. Three two-man crews were organized to assist in certain phases of the work in addition to their other specific assignments. Salinas and Poole conducted intensive investigations on census methods in the Flathead and Blackfoot valleys. Smith and Ritzer continued the reservoir studies in the southern unglaciated region. Freeman and Goers continued breeding ground investigations in the remaining portion of Montana and worked with the other crews at specific intervals.

The personnel of the Missouri River Basin Studies Program again made census flights over trend area number 1 in eastern Montana.

Canada geese were banded at Bowdoin Wildlife refuge through a cooperative effort with the Fish and Wildlife Service.

Methods

The geological divisions of Montana as described in "Waterfowl Breeding Conditions in Montana - 1949" (Crissey and Others 2/) were again used as the basis for our surveys. The basic census approaches which were used in 1949 were continued. Densities of waterfowl which occupy the several geographic regions of the State were computed from aerial transect samples. The species composition of the waterfowl on these areas was determined from roadside census.

The aerial census was begun soon after it was determined that the spring migration was nearing completion. Three planes were used in order to complete the census in as short an interval of time as possible. The area covered by the aerial census transects (See Crissey and Others op. cit. P 128) was 1,107 square miles.

The ground transects used were essentially the same as were used in 1949. The exceptions made were considered necessary in order to give a more equitable coverage for the areas involved.

1/ U. S. Fish and Wildlife Service, Missouri River Basin Studies; personnel of the State Fish and Game Department: Assistant Big Game Biologist Don Brown, pilot; Field Assistant George Goers; and Student Assistants Richard Smith, Henry Ritzer and Daniel Poole, all took part in certain phases of the investigation.

2/ Crissey, W. F. and Others, "Waterfowl Populations and Breeding Conditions Summer 1949", Special Scientific Report: Wildlife No. 2, pp 128-135.

Climatic Conditions

The winter of 1950 varied from about average in a very few counties to very severe in many northern counties where the coldest January in 56 years was recorded. In addition to the cold, snowfall was heavy in most of the northern counties.

Snow and freezing temperatures continued to the second week in May when the weather returned to "normal". Soil moisture was deemed adequate throughout the State. Potholes and reservoirs were filled that had been dry or very low for the past two years. At this time it was estimated that plant growth and the crop planting season had been delayed about two weeks.

On June 7 and 8, frosts and freezing temperatures were prevalent throughout the State. Precipitation was heavy in all but a few areas. Glasgow reported 4.12 inches for the week. The "Highline" Area (Glasgow, Fort Peck and Medicine Lake) also reported from four to eight inches of wet snow during the period. The total effect of this late freeze and snowfall has not been determined, but in one area several nests were observed as abandoned. Waterfowl were known to be incubating as the first mallard brood was observed on May 22. In addition, a great many paired mallards, pintails, and gadwalls were noted as late as June 20. This condition seems to be indicative of large-scale renesting attempts.

Weather and water conditions have remained excellent for waterfowl production since the first week in June.

Results

Aerial trend counts were taken along flight lines established in the spring of 1949. However, the census was conducted approximately one week earlier in 1950 than in 1949. This may have some slight effect on the validity of the comparisons. The repeated use of a given calendar date as a basis for beginning aerial census injects a possible source of unknown error. This source of unknown error must be recognized, unless the time set for beginning the breeding ground census can be correlated with some biological phenomenon closely associated with the spring migration.

A description of the trend methods and census routes may be found in the 1949 report (Crissey and Others op. cit.).

The data gathered from the Highline Glaciated Prairie Area and the Great Falls Piedmont Area (Figure 1) were analyzed by the application of the "t" test for significance. The computed value of "t" was compared with Fisher's "Table of t" in order to check the significance of the data obtained. This test was applicable since the same transects were used during 1949 and 1950 and resulted in paired data.

The formula used was: $t = \frac{D}{Ed}$

Where: D = The difference between the means

Ed = The standard error of the difference between the means

Although more birds were observed in the Great Falls Piedmont Area, the 1950 trend data did not show significance when the "t" test was applied. The entire increase in birds per square mile (Table 1) was attributed to only one transect. The validity of attempting to apply, to the area as a whole, this increase in birds per square mile attributed to a single transect is doubtful. However, it can be said that the 1950 waterfowl population in this area was at least equivalent to and possibly slightly greater than that of 1949.

Table 1. -- Total ducks by area, square mile, and water area as determined from aerial surveys

Area	Sq. Miles Sampled		Ducks per Sq. Mile		Total Water Areas		Ducks per Water Area	
	1949	1950	1949	1950	1949	1950	1949	1950
Highline Glaciated	314.9	306.1	5.5	8.3	455	1037	3.8	2.4
Great Falls Piedmont	137.1	138.3	15.5	23.0	251	596	6.8	5.3
South Unglaciated								
Trend Areas	516	516	1.1	1.1	137	137	4.2	4.1
Transects	89.4	124.4	3.1	6.7	93	136	3.0	6.1
Western Mountains								
Trend Area A	9	9	54.0	34.1				
Trend Area B	12	13	46.9	48.2				

The value of "t" for the 1950 data on the Highline Glaciated Prairie Area lies close but not within the 95 percent level of significance. The data might have revealed increased significance if the area had been more completely covered. The flight strips were six miles apart and gave slightly better than a two percent coverage. This coverage was as intensive as was considered economically feasible. The data are significant at the 90 percent level, however, and upon this premise it is safe to assume that there was a valid increase in the breeding population.

The census of the Southern Unglaciated Prairie Region (Figure 1) indicated a slightly larger population of breeding birds in 1950 as compared to 1949. A method of statistical analysis has not been worked out for these data as yet, but an effort is being made to develop one. The trend areas which have a combined total of 516 square miles showed a total of 576 birds in the spring of 1949 as compared with 556 birds in the spring of 1950. The difference of 20 birds is hardly significant and could be attributed to a sampling error. However, the transect data covering 124 square miles showed an increase of over 50 percent in total number of birds observed.

The waterfowl breeding population in the mountainous valleys, as determined from the trend areas, was down in 1950 (Table 1). The area involved in the mountainous regions is considerably smaller than any of the other geological breakdowns of the State.

The total breeding ground population of ducks in 1950 was concluded to be slightly larger than the total population estimated in 1949.

Although the species composition of waterfowl for the five important breeding areas of Montana indicate some changes between 1949 and 1950, the percent of the total for most species shows an essential similarity (Table 2). The relative importance of the mallard, pintail, and blue-winged teal remains unchanged. The usual exception comes from the mountainous area where the redhead again occupies second place in species composition.

Large fluctuations of individual species are apparent in specified geological subdivisions. Mallards in the southern unglaciated prairie dropped more than 50 percent in species composition for that area. The percentage of composition for scaup dropped from 17.3 percent in the western mountains in 1949, to 4.3 percent in 1950. However, the composition of scaup in the Sheridan terminal moraine was almost the reverse (see Table 2). The percent composition of baldpates nearly halved in 1950 for the Highline and western valleys but a considerable increase was recorded for the southern prairie.

Table 2. — Waterfowl Species Composition for the Five Important Breeding Areas of Montana during 1949 and 1950

	Highline Glaciated Prairie		Great Falls Piedmont Area		Southern Unglaciated Prairie		Sheridan Terminal Moraine		Western Mountain Valleys	
	% of spec. comp.		% of spec. comp.		% of spec. comp.		% of spec. comp.		% of spec. comp.	
Species	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
Mallard	38.6	21.6	37.2	45.1	43.2	21.7	23.8	19.8	19.3	33.3
Gadwall	7.2	6.1	1.2	4.1	1.2	9.9	8.9	2.7	3.3	3.4
Baldpate	14.7	7.4	5.9	3.9	1.2	6.0	5.0	6.3	14.9	8.3
Pintail	18.3	23.7	18.8	16.8	18.9	15.4	25.2	19.8	6.0	4.0
G-w. teal	5.7	1.7	2.9	—	6.9	2.9	—	0.4	2.9	1.7
B-w. teal	11.0	15.0	9.5	12.2	20.2	16.1	14.3	18.8	5.5	8.7
Cinn. teal	—	—	—	0.5	T	0.9	—	—	1.6	1.1
Shoveler	7.4	6.1	5.9	3.4	1.2	9.0	8.9	13.1	6.7	3.3
Redhead	—	6.4	3.4	2.3	0.4	1.4	1.9	2.0	15.3	16.8
Canvasback	0.3	2.3	1.2	—	—	—	0.3	0.4	1.0	0.2
Scaup	1.3	6.3	6.4	6.0	T	8.0	4.7	15.7	17.3	4.3
Golden-eye	—	0.4	—	—	—	—	—	—	1.3	1.3
Bufflehead	—	0.4	—	2.1	—	1.1	—	—	1.9	—
Ruddy	—	3.0	—	3.6	—	3.7	—	0.8	3.0	1.6
Unidentified	0.2	—	—	—	1.2	4.6	—	—	T	12.0

The severe winter and the wet spring combined to increase the available water areas in the spring of 1950 to over 100 percent of the total available in 1949 (Table 1). The greater part of this increase in water areas, however, was classed as temporary. In areas along the Highline glaciated area, as many as 63 percent of the original water areas were dry by July 21. However, the areas that were becoming dry were all temporary puddles which in this area have little effect on the over-all production.

The vagaries of the spring weather resulted in large scale disruption of the first nesting attempts. The general freezing temperature and the snowfall occurring in early June caught many birds in the process of incubating. Several nests were classed as deserted during this period. Class 1 broods observed during early June were noticeably small. Especially noticeable were the pintail broods, where a hen with one duckling was not uncommon. On Trend Area A (Crissey and Others p 128 op. cit.) between May 18 and June 16, intensive studies were conducted during which 2,880 ducks were observed and only 12 broods were seen.

Large concentrations of paired gadwalls, shovelers and blue-winged teal, plus scattered pairs of mallards and pintails as late as June 20 were indicative of large scale renesting attempts. Renesting attempts were successful, however, and resulted in average brood sizes equivalent to or slightly larger than comparable brood sizes in 1949. (See Table 3)

The late nesting season is exemplified by this statement (correspondence) by Leon Snyder, Refuge Manager of Bowdoin Wildlife Refuge, on August 13, ".... downy ducklings of all species are quite common." In addition, broods of blue-winged teal were also noted as less than one week old as late as August 20.

An indication as to the success of the renesting attempts is gathered from a count of females with broods as compared to females without broods made during the week of August 21 through August 27. Females with broods constituted 75 percent of the identified total mallards, blue-winged teals and pintails.

Table 3. -- Waterfowl Broods by size and age classes - State of Montana, 1949-50

Species	Class 1		Class 11		Class 111	
	1949	1950	1949	1950	1949	1950
Mallard	5.6	6.4 (380/59)*	5.4	5.8 (780/134)	5.2	5.8 (238/42)
Gadwall	5.0	7.8 (94 /12)	6.5	6.4 (262/ 41)	2.0	6.7 (80/12)
Baldpate	6.7	7.0 (84 /12)	10.0	6.8 (360/ 53)	7.0	6.5 (91/14)
Pintail	5.7	5.3 (101/19)	5.9	5.5 (376/ 69)	4.5	6.0 (429/71)
G-w. teal	6.3	4.7 (14/ 3)	5.3	6.3 (82/ 13)	6.0	6.7 (99/15)
B-w. teal	7.4	8.0 (589/74)	6.5	4.7 (663/142)	5.1	6.8 (81/12)
Shoveler	6.7	7.0 (28/ 4)	7.5	6.8 (493/ 73)	7.5	6.5 (130/20)
Redhead		5.0 (55/11)		4.5 (18/ 4)		
Canvasback			8.3	7.2 (36/ 5)	3.0	
Scaup	9.0	9.0 (9/ 1)	7.3			
Golden-eye		6.0 (12/ 2)	15.0	7.5 (15/ 2)	5.0	
Ruddy	6.0	5.7 (40/ 7)		3.0 (6/ 2)	1.3	

* Considerable brood information was obtained from Gene Crawford, Refuge Manager, Medicine Lake Wildlife Refuge.

Summer banding was again incidental to other field work. However, a cooperative goose banding program at Bowdoin Wildlife Refuge netted 143 geese. Two men from the refuge, Flyway Biologist G. Hortin Jensen, and four State men made up the banding crew.

Summary

1. Breeding ground investigations were conducted in Montana for the second straight year.

2. Aerial and roadside census routes established in 1949 were again utilized in 1950.

3. Snow and freezing temperatures in early June disrupted early nesting and caused large scale renesting throughout the State.

4. The breeding ground population of waterfowl was slightly larger than the population observed in 1949.

5. Species composition of the breeding population was essentially the same in 1950 as it was in 1949. A very few individual species on individual geological areas showed large fluctuations in species composition. Mallards, pintails, and blue-winged teal were again the most important breeding ducks in Montana.

6. The success of the renesting attempts made the average brood sizes observed equivalent to or slightly larger in 1950 as compared to 1949. The lateness of the season was exemplified by many downy young of all species being observed as late as August 13.

7. Banding was incidental to other activities. However, 143 geese were banded on Bowdoin Wildlife Refuge.

WATERFOWL BREEDING GROUND SURVEY IN NORTH DAKOTA - 1950

Brandt V. Hjelle

Introduction

The third annual State-wide survey of migratory waterfowl breeding grounds, carried out cooperatively by the Branch of Game Management and Office of River Basin Studies of the Fish and Wildlife Service, and the North Dakota Game and Fish Department, was completed during the latter part of May and the first part of June, 1950.

The survey included: (1) An aerial survey of the entire State on an equal basis for the purpose of determining mass waterfowl populations; and (2) A State-wide ground survey made in as random and complete a manner as possible for the purpose of obtaining information as to species composition and observed sex ratios, and also to furnish indices to waterfowl populations and waterfowl habitat.

The Aerial Survey

The spring of 1950 brought an unusual increase in surface water present in a large portion of North Dakota. This condition increased the time and effort required to obtain a satisfactory water and waterfowl inventory on the 17 one-half mile wide sample strips used in the 1948 and 1949 surveys to such an extent, that it was soon decided to limit the 1950 survey to only an inventory of ducks on the north one-half of the previously selected sample strips. Accordingly, the major part of the 1950 survey was done on a quarter-mile basis, rather than a half-mile basis as was done in 1948 and 1949.

The Game Management Division of the Fish and Wildlife Service, using a Grumman 'Widgeon', covered strips 3, 7, 11, and 15, on a quarter-mile basis.

The Office of River Basin Studies, using the same crew and type of plane as used in the previous surveys, again covered strips 6 and 9, but this year on a quarter-mile basis.

The Federal Aid Division of the North Dakota Game and Fish Department, using in large part the same planes and crews used in the previous survey, covered the remaining strips, all of which were done on a quarter-mile basis, except for strips 14 and 15, and that part of 16 west of the Missouri River, which were again covered on a half-mile basis.

Because of an unusually late spring, this year's survey was made about two weeks later than that of 1949. The 1950 aerial survey was begun on May 21, with the greater part being finished by June 9. However, strips 6 and 9 and the west part of strips 12 and 13 were not completed until June 13.

It is believed that the timing of this year's survey in general is such that it is comparable with the surveys of 1948 and 1949.

Except for the reduction in sample size and the elimination of water area data, techniques and procedures were essentially the same as in previous surveys and are fully explained in the 1948 report.

Table 1 summarizes the data gathered.

Table 1. -- Summary of Waterfowl Data Obtained in Aerial Survey in North Dakota - Spring, 1950

Note: Strips 14 and 15 covered on one-half mile basis; all others on one quarter-mile basis.

Strip No.	Sq. Mile Sampled	Total Ducks Seen	Ducks Per Sq. Mile
1	69.0	2767	40.1
2	80.0	2773	34.7
3	79.5	1970	24.8
4	79.5	1956	24.6
5	80.0	1788	22.4
6	80.7	5306	65.7
7	83.0	2042	24.6
8	83.0	1378	16.6
9	84.0	1835	21.8
10	85.0	1917	22.6
11	85.0	1257	14.8
12	85.0	1217	14.3
13	86.0	1132	13.2
14	172.5	1975	11.4
15	175.5	2153	12.3
(15)[2]	(88.0)	(1163)	(13.2)
16[3]	89.0	1727	19.4
17	90.0	1955	21.7
Totals	1586.7	35,148	22.2

1 Ranges 71, 72, 73, 74, 75, and 76 not included.

2 Strip 15 data in parenthesis obtained in quarter-mile survey by Fish and Wildlife Service. Not included in totals.

3 Totals from one-half mile survey of strip 16 west of Missouri River halved.

The Ground Survey

Primarily for the purpose of determining species composition and sex ratios of resident waterfowl, ground counts of all waterfowl seen within one-eighth mile on either side of the road along selected routes were again made.

Impassable roads, due to high water, made it impossible to make all counts identical with those of previous years. Also, expansion of the ground counts made by Federal Aid personnel necessitated a re-numbering of some counts. For these reasons the data presented this year are in some cases not absolutely comparable with that previously presented for other years. However, the over-all trend should be reliable.

These ground counts were made during the period May 20 to June 2, which was about ten days later than the 1949 counts. It is believed that the timing was such that they are reasonably comparable with corresponding counts made in 1948 and 1949. Also, it is believed that all of the 1950 counts are satisfactorily indicative of waterfowl present.

Table 2 summarizes the data gathered during the ground survey. The species composition is shown in Table 3.

Table 2. -- Summary of Waterfowl and Water Area Data Obtained in Ground Survey of Breeding Grounds in North Dakota - Spring, 1950

			WATERFOWL				
Strip No.	Lineal Miles	Sq. Mi. Sampled	Breeding Pairs	Total Ducks Seen	Breeding prs. per Sq. Mi.	Ducks per Sq. Mi.	Coot
1	242.0	60.5	377	557	6.2	9.2	51
11	242.0	60.5	474	738	7.8	12.2	11
111	232.0	58.0	790	1178	13.6	20.3	175
1V	233.0	58.0	1547	2580	26.7	44.5	336
V	245.0	61.0	1186	1879	19.4	30.8	340
V1	211.0	53.0	693	1129	13.1	21.3	384
V11	205.0	51.0	459	794	9.0	15.5	360
V111	211.0	53.0	72	116	1.4	2.2	35
Totals	1821.0	455.0	5598	8971			1692
Average					12.3	19.7	

			WATER AREAS			
Strip No.	Lineal Miles	Sq. Mi. Sampled	Total Number	Total Acres	Number Per Sq. Mi.	Acres per Sq. Mile
1	242.0	60.5	261	422	4.3	69.7
11	242.0	60.5	506	1068	8.4	17.7
111	232.0	58.0	735	573	12.7	9.9
1V	233.0	58.0	654	1074	11.3	18.5
V	245.0	61.0	927	1310	15.2	21.5
VI	211.0	53.0	1169	689	22.1	13.0
V11	205.0	51.0	684	3018	13.4	59.2
V111	211.0	53.0	242	580	4.6	10.9
Totals	1821.0	455.0	5178	8734		
Average					11.4	19.2

Table 3. -- Species Composition and Sex Ratio of Ducks Recorded During Ground Survey of Breeding Grounds in North Dakota - Spring, 1950

Species	Male	Female	Total	Species Composition % Total	Species Composition % Males
Blue-winged teal	1762	1337	3099	33.8	31.7
Pintail	1681	667	2348	26.4	30.2
Mallard	701	359	1060	11.9	12.6
Shoveler	631	420	1051	11.8	11.4
Gadwall	230	200	430	4.8	4.1
Redhead	144	109	253	2.8	2.6
Baldpate	103	83	186	2.1	1.9
Ruddy	106	73	179	2.0	1.9
Canvasback	119	53	172	1.9	2.1
Scaup	74	39	113	1.3	1.3
Green-winged teal	4	3	7	T	T
Others	3	1	4	T	T
Totals	5558	3344	8902		

Population Trends

Comparison of the basic data from the 1949 and 1950 aerial counts indicates an increase of approximately 40 percent in breeding ducks in 1950. However, after applying correction factors obtained in the ground counts, the over-all increase indicated by the aerial survey is reduced to approximately 33 percent.

Comparison of the data from comparable ground counts indicates an increase of approximately 18 percent in breeding pairs of ducks in 1950.

On the basis of these data, it is concluded that the 1950 spring breeding populations of ducks in North Dakota was approximately 25-30 percent greater than that of 1949.

WATERFOWL BREEDING GROUND SURVEY IN SOUTH DAKOTA - 1950

Ray Murdy

Introduction

Waterfowl breeding ground studies in South Dakota were greatly expanded during 1950. An aerial waterfowl and water area survey was initiated to measure the density and distribution of breeding ducks and water areas on a State-wide basis. The number and distribution of ground transects were increased to give State-wide coverage. A brood census was initiated on portions of certain ground transects in an effort to establish indices relating numbers of broods to numbers of pairs and to square miles of coverage. Other brood counts were made to estimate average brood sizes by species and age classes. And lastly, a joint duck-banding program was undertaken with the U. S. Fish and Wildlife Service.

This report contains a brief resume of the studies mentioned above. Each will be dealt with in detail in future Quarterly Progress Reports of Pittman-Robertson Project 17-R-3. The results of the duck banding activities are discussed by J. H. Stoudt, Biologist, U. S. Fish and Wildlife Service, and are not described in this report.

Field Methods

Ground Transects

The type of ground transect used was the standard 1/4-mile wide transect with ducks being recorded by species as pairs, lone drakes, unpaired drakes, and unpaired females. Water areas were classified according to size, permanency, and occupancy. These ground transects were run by 42 State game wardens in 49 counties spread over the entire State (Figure 1). The 2,312 miles flown resulted in a coverage of 578 square miles. Of this, 309 square miles represented transects in the East River country which had been run in 1949, and so can be used to measure trends. This survey was made during the 4th week of May (21-27) as the late spring appeared to have set back the breeding season about three weeks.

Aerial Transects

The aerial transects were laid out east-west across the State at 12-mile north-south intervals beginning 12 miles south of the North Dakota-South Dakota State Line continuing across the State to a point 12 miles north of the Nebraska State Line. This year every other transect was run, resulting in 8 east-west transects 24 miles apart. The approximate location of these transects is indicated by the rows of figures in Figure 2. These transects were 1/2 mile wide. Ducks were recorded as the number observed, and water areas were listed as the number and acreage by permanency classes. All data were recorded by sections; i.e. the number of ducks and the number and acreage of water areas in each permanency class were recorded for each mile along the transect. Six transects were flown by State game technicians and 2 were flown by Lloyd Ayers, Biologist, U. S. Fish and Wildlife Service, River Basin Studies. These transects were flown at the same time as the transects were being run on the ground.

Brood "Census"

The brood "census" was made in an attempt to establish indices to brood densities and the ratio of pairs of breeding ducks to numbers of broods. Portions of

ground transects in 14 counties in the northeastern quarter of the State were rerun August 9-12 during what was believed to be the peak of the hatch. The runs were made from daylight until 8:00 a.m. and from 6:30 p.m. until dark. The coverage obtained was 147.5 square miles. The information recorded was the number of broods that could be seen from the road by inspecting all water areas with binoculars.

Counts of the sizes of duck broods were made whenever broods were observed. The data were recorded by species and age classes. These counts were made mostly during the early morning and evening hours from June 11 to August 31. Broods were classified as complete or incomplete counts depending on whether or not it seemed probable that all of the ducklings in the brood were visible at the time of the count.

Weather and Water Conditions

Low temperatures and frequent storms made the spring of 1950 a poor one for waterfowl nesting. The average temperatures for March, April, May, and June were 7.0, 7.8, 3.9, and 0.2 degrees below normal respectively. April was one of the coldest months on record. Precipitation was 0.75 inch above normal in March, 0.79 inch below in April, 0.33 inch above in May, and 2.14 inches below in June. A blizzard on March 6-7 may have been the most severe on record for eastern South Dakota. Snow storms occurred on March 25-27, April 10, 24-25, and 29, and May 5, 7-8. Strong winds and hail hit the northern Coteau des Prairie on June 22-24. This adverse weather during the spring resulted in later spring migration and what appeared to be a three-week set-back in breeding activity, especially in the northern Coteau des Prairie.

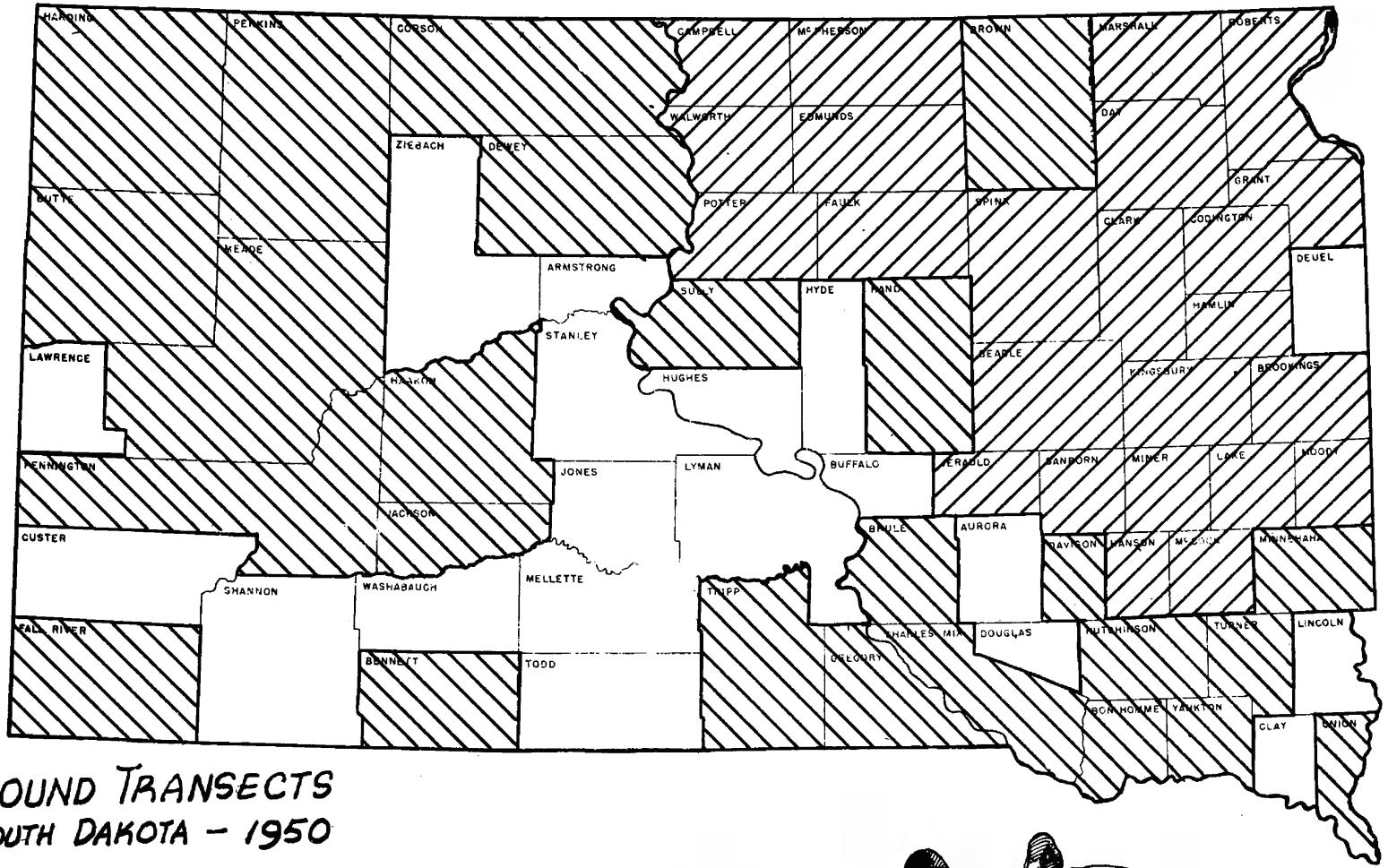
Trends in the density of water areas were calculated from the ground transects which had been run in 1949. In 1949 there was an average of 3.1 water areas per square mile. This year the average density was up 68 percent, or 5.2 water areas per square mile. This trend was general over the northeastern quarter of the State. Only 3 of the 22 transects showed a decrease in water area density. The increase in water area density, accompanied by an increase in ducks, resulted in practically the same degree of occupancy as existed in 1949. In 1949, 80 percent of the water areas were occupied; this year the percent of occupancy was 79.

Population Levels, Distribution, and Trends

The aerial waterfowl and water area survey covered 1,488 square miles of gridded transects. On this area 9,804 ducks were observed, indicating an average density of 6.59 ducks observed per square mile. This value does not take into consideration females on the nest. The ground transect data indicate that at the time of these surveys 20.0 percent of all the birds observed were lone drakes, each representing an absent female. To correct for females on the nest, the average density of observed birds was multiplied by 1.20. The product indicates an average Statewide density of 7.91 ducks per square mile. It should be kept in mind that this value represents the minimum average density of ducks because in aerial transect work a certain undetermined but substantial portion of the ducks are not seen.

Figure 2 indicates the distribution of breeding ducks in South Dakota, as indicated by the aerial transects. The figures plotted are the number of ducks actually observed per 12-mile segment of transect (6 square miles) with no correction for females on the nest.

Trends in the population levels of waterfowl were determined from the ground transects because there were no comparable data for the aerial transects in 1949. Changes in the density of breeding waterfowl were calculated from the ground transects which were run in both 1949 and 1950. The counties represented are indicated in



GROUND TRANSECTS
SOUTH DAKOTA – 1950

COUNTIES IN WHICH TRANSECTS WERE ESTABLISHED IN 1950

COUNTIES IN WHICH TRANSECTS WERE RUN IN BOTH 1949 AND 1950

Blank Page Digitally Inserted

Table 1. -- Trends in Duck Densities on Ground Transects, 1949-1950

County	Total Pairs Per Sq. Mi.		Total Ducks Per Sq. Mi.		Percent Change	
	1949	1950	1949	1950	T. Pairs	T. Ducks
Beadle	0.9	8.3	1.8	17.1	+ 820	+ 850
Brookings	9.0	3.7	14.4	6.5	— 59	— 55
Campbell	15.9	16.8	27.2	27.7	+ 6	+ 2
Clark	10.5	12.0	25.0	25.1	+ 14	0
Codington	15.3	15.5	26.6	28.0	+ 1	+ 6
Day	14.7	13.1	26.4	23.0	— 10	— 13
Edmunds	41.2	49.4	56.6	86.2	+ 20	+ 52
Faulk	13.2	32.3	20.4	53.8	+145	+ 61
Grant	18.3	25.6	36.5	40.0	+ 40	+ 10
Hamlin	8.6	7.3	15.7	13.6	— 15	— 13
Kingsbury	13.1	5.5	23.8	9.1	— 58	— 62
Lake	4.5	8.3	8.2	12.8	+ 85	+ 54
McCook	6.3	6.0	10.2	7.5	— 5	— 26
Jerauld	5.1	20.0	9.9	33.2	+ 292	+ 236
Marshall	24.7	34.6	46.0	61.2	+ 40	+ 33
McPherson	28.6	34.5	40.0	53.0	+ 21	+ 32
Miner	4.4	4.1	8.6	6.6	— 7	— 23
Moody	5.6	4.8	8.2	9.2	+ 14	+ 12
Potter	25.6	12.9	38.4	21.8	— 50	— 43
Roberts	54.6	60.8	108.8	104.8	+ 11	— 4
Sanborn	5.4	20.4	10.9	30.8	+278	+ 182
Walworth	4.1	16.0	6.2	24.3	+290	+ 293
Totals [1]	14.0	18.0	25.4	31.0	+ 29	+ 22

Footnote: 1 - Averages calculated from totals for all the transects and not averages of the individual transect averages.

Figure 1 and the data for each county and the total sample appear in Table 1. The density of ducks on ground transects is expressed as "total pairs" and "total ducks" per square mile. The former represents pairs actually observed as such plus the pairs indicated to be present by the presence of lone drakes. Total ducks refers to all of the ducks actually seen on the transects with no correction for females on the nest, and included unpaired as well as paired birds.

The 22 ground transects which were run in 1949 and 1950 covered 309.1 square miles. The number of total pairs and total ducks observed on these transects were 5,585 and 9,574 respectively, indicating an average density of 18.0 total pairs and 31.0 total ducks per square mile. This is a 29 percent increase over the 1949 density of 14.0 total pairs per square mile and a 22 percent increase above the 1949 density of 25.4 total ducks per square mile. Two thousand, seven hundred and seventy-three coots were recorded, which indicates an average density of 9.0 coots per square mile. This is double the 1949 level of 4.5 coots per square mile.

Trends in Species Composition

Trends in the species composition of the breeding ducks were calculated from the ground transects which were run in both 1949 and 1950. The percent composition was calculated from the number of total pairs which were observed on this sample. A comparison of the species composition in 1949 and 1950 is made in Table 2. Three changes are evident: The blue-winged teal decreased 2 percent and the pintail and ruddy both increased 1 percent in respect to their percent composition of the total population.

Table 2. -- Trends in the Species Composition of the Breeding Population

Species	Number of Total Pairs		Percent Composition		Percent Change
	1949	1950	1949	1950	
Blue-winged teal	2,227	2,413	45	43	- 2
Pintail	829	1,084	18	19	+ 1
Mallard	853	975	17	17	0
Shoveler	426	513	9	9	0
Gadwall	260	261	5	5	0
Redhead	161	151	3	3	0
Ruddy	53	84	1	2	+ 1
Scaup	64	36	1	1	0
Baldpate	36	45	1	1	0
Canvasback	13	19	- 1	- 1	0
Totals	4,922	5,586			

Brood "Census"

The data relating the number of broods seen during the brood "census" to the number of pairs of ducks and the square miles covered appear in Table 3. To compare the number of broods to the number of pairs, the number of pairs was taken from the portions of the spring ground transects which were covered during the brood census. In relating numbers of broods to square miles covered, the same transect width (1/4 mile) was assumed as was used in the spring ground transect survey. It should be remembered that these values are nothing more than indices and are of little value until next year's data can be compared with them.

Table 3. -- Duck Brood Census Data

County	Number Broods	Square Miles	Number Pairs	Pairs Per Brood	Broods Per Sq. Mi.
Beadle	7	13.2	104	15	0.53
Brookings	3	12.7	46	15	0.24
Brown	5	13.6	253	51	0.37
Day	11	10.2	149	14	1.08
Edmunds	3	4.2	165	55	0.72
Faulk	18	7.0	320	18	2.57
Grant	9	10.8	233	26	0.83
Hamlin	1	14.2	110	110	0.07
Kingsbury	13	13.4	73	6	0.97
Lake	16	19.5	166	10	0.82
Marshall	3	3.0	92	31	1.00
Miner	0	10.2	36	-	0
Moody	0	6.5	30	-	0
Roberts	33	9.0	538	16	3.70
Totals	122	147.5	2,315	19	0.83

Brood Sizes

Complete counts were made of the number of ducklings in 527 broods of 9 species. The average brood size for all species and age classes was 7.02. Class 1 broods averaged 7.37 ducklings per brood; Class 11, 6.84; and Class 111, 6.70. The data pertaining to average brood size and sample size by species and age classes appear in Table 4. Brood counts were not made in 1949 so no comparison can be made with brood sizes that year.

Table 4. -- Average Brood Sizes

Species	Class 1		Class 11		Class 111		Total	
	No. Broods	Av. Size	No. Broods	Av. Size	No. Broods	Av. Size	No. Broods	Av. Size
Blue-winged teal	107	8.11	80	7.15	62	7.42	249	7.67
Mallard	35	7.06	18	7.39	16	6.94	69	7.12
Pintail	22	5.00	15	3.73	46	5.30	83	4.95
Shoveler	6	7.67	3	6.67	14	5.82	26	7.00
Gadwall	27	7.19	25	7.32	12	7.92	64	7.38
Ruddy	8	5.50	8	6.63	1	5.00	17	5.00
Redhead	9	7.56	2	9.00	-	-	11	7.82
Baldpate	2	9.00	3	6.33	1	7.00	6	7.33
Canvasback	1	9.00	1	7.00	-	-	2	5.50
Totals	217	7.37	155	6.85	155	6.70	627	7.02

Summary

1. Waterfowl breeding ground investigations by the South Dakota Department of Game, Fish and Parks in 1950 included a continuation and expansion of the survey by ground transect and the initiation of an aerial waterfowl and water area survey, a brood "census", brood size counts, and a cooperative banding program.

2. Weather conditions during the spring were very unfavorable for waterfowl nesting. Low temperatures and frequent storms resulted in a delay in breeding activity that was estimated to be about three weeks.

3. Water area data from 309.1 square miles of ground transects which had been run in both 1949 and 1950 showed a 68 percent increase in the density of water areas. This spring there was an average of 5.2 water areas per square mile as compared with the 1949 density of 3.1 water areas per square mile.

4. The average minimum duck density on a State-wide basis, as indicated by 1,488 square miles of gridded aerial transects, was 7.91 ducks per square mile. This value includes females which were on the nest at the time of the survey and so were not observed. The correction for the unobserved females, based on the observed sex ratio obtained by the ground transects, was plus 20.0 percent of the ducks observed.

5. The distribution of the breeding ducks was obtained from the aerial waterfowl and water area survey. This survey showed what is believed to be the usual relatively medium and high duck densities in the Coteau des Prairie and the Leola Hills. Surrounding the Leola Hills and extending south through Faulk County to northern Hyde and Hand Counties was a large area of high duck density that is not considered normal and which is attributed to the large increase in the amount of water present this spring and the late breakup of water areas in the northern Coteau des Prairies and possibly areas to the north. Two other areas of high duck density occurred to the south, one west of the Missouri in eastern Stanley and northern Lyman and Jones Counties and one east of the Missouri in eastern Buffalo and Brule and western Jerauld and Aurora Counties.

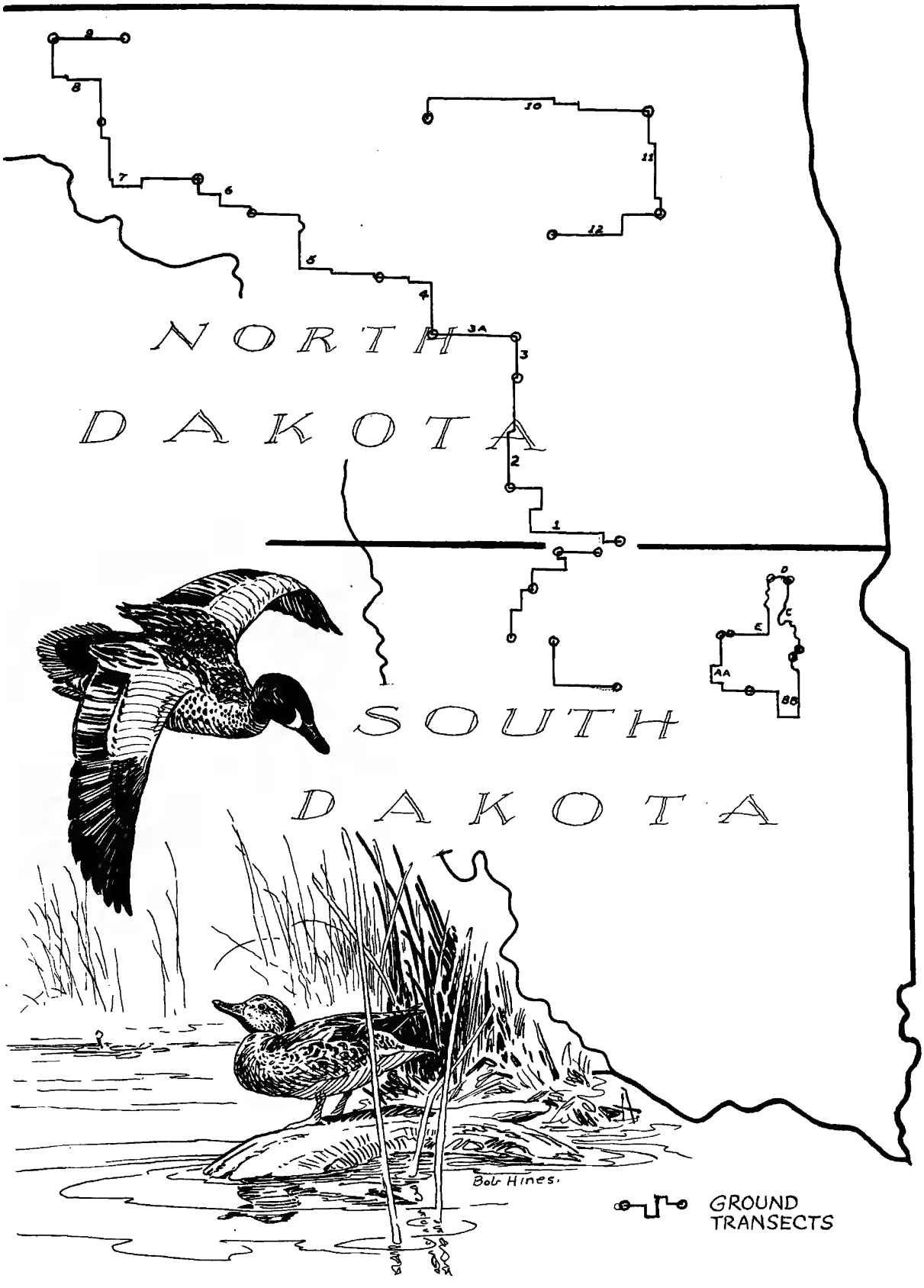
6. Population trends on 309.1 square miles of ground transect run in both 1949 and 1950 were increases of 29 percent in the number of total pairs and 22 percent in total ducks. The density of coots on these transects was exactly double the 1949 density.

7. Trends in the species composition of the ducks on the ground transects which were run in 1949 and 1950 showed changes for three species. The blue-winged teal decreased 2 percent and the pintail and ruddy duck both increased 1 percent in respect to their percent composition of the total population.

8. Brood "censuses" on 147.5 square miles of ground transects in 14 counties indicated an average breeding-pairs-per-brood index of 19 and an average brood density index of 0.83 brood per square mile. No data are available for comparison with previous years.

9. Complete counts of the size of 527 duck broods of 9 species indicated an average size for all species and age classes of 7.02 ducklings per brood. For all species the average brood sizes for the 3 age classes were Class 1, 7.37; Class 11, 6.84; and Class 111, 6.70 ducklings per brood. No data from previous years are available for comparison.

WATERFOWL BREEDING GROUND SURVEY~ 1950



Blank Page Digitally Inserted

WATERFOWL BREEDING GROUND SURVEY IN THE DAKOTAS - 1950

Jerome H. Stoudt

Introduction

For the third consecutive year a waterfowl breeding ground survey was conducted in the Dakotas. Transects were run on the ground for the following purposes:

1. To determine population trends of breeding pairs of waterfowl.
2. To determine trends in brood production.
3. To establish permanent ground transects for future use for either breeding pairs, broods, or both.

With the latter idea in mind several new transects were laid out which added to the over-all coverage but cut down on dead-heading between transects (see map).

Personnel assisting in the 1950 surveys included: - Harry Jensen and Everett Sutton of the Branch of Game Management; Refuge Manager Fred Staunton; Biological Aid H. W. Egert. Brood data were also contributed by P-R Biologist Leo Kirsch. These were collected incidental to pheasant census work.

Area Covered

The accompanying map shows the ground transects in 1950 which will be used in the future for both breeding pair counts and to restricted degree for brood counts. The spring of 1950 was one of the most unusual in history with the migration of most species delayed for two or three weeks and more water present in many areas than had been the case for the past 50 years. This caused much flooding of roads, many of which were still under water on September 1. Some transects which were run in 1949 could not be run at all and only portions of others. This was only true in North Dakota, however, with all 1949 transects in South Dakota being censused again in 1950. All transects were run about 12 days later in 1950 than in 1949 and it would appear that they could have been postponed another week.

The 1950 transects include a good sample of the Waubay Hills and Leola Hills in South Dakota and extend from the latter northwesterly through the Coteau Hills of North Dakota to Saskatchewan. Enough flat or gently rolling agricultural land is included between and adjacent to the Hills areas to give a fair sample of waterfowl populations in this type of habitat.

Transects are for the most part in better than average waterfowl habitat and do not yield a population figure per square mile which can be applied to the entire area of the Dakotas. Transects were selected to give a maximum number of observations with a minimum amount of coverage, always keeping in mind the main objectives of population trends and determination of species composition. For accuracy in both, compare the trends and species composition with State data elsewhere in this report and note similarity.

Weather and Water Conditions

As previously stated, the spring season of 1950 was extremely abnormal. Blizzards occurred as late as May 5 in South Dakota and even later in North Dakota. The last two snowstorms in North Dakota brought approximately 17 inches of precipitation and caused severe flooding of roads in the land-locked potholes and sloughs of the hills region in central North Dakota.

Many pintails and mallards had moved ahead of or "jumped over" the snow and ice sheet in northern South Dakota and North Dakota to go on further north where the arrival of spring weather was on schedule or even earlier than usual. But most of the waterfowl including shovelers, gadwall, teal, diving ducks, and snow and blue geese were delayed from two to three weeks in their northward migration.

Observations of full-grown broods of pintails in the first week in July which were starting to fly indicated that some pintails started nesting in mid-April and actually brought their nests through several severe blizzards which piled up snow several inches deep wherever nesting cover occurred. Sub-freezing temperatures followed most of the snowstorms. However, the main hatch of ducks was delayed and the big hatch came off in North Dakota during the first ten days of August instead of shortly after mid-July, as is normally the case. Actually the nesting season was spread over a longer period than usual and newly hatched broods were seen as late as August 29 with more to come off no doubt.

In many permanent water areas over-the-water nesting cover in the form of bulrushes, cat-tail, etc., was completely inundated and in many areas was flooded out for the summer. In other areas that were about to dry up and become land communities the additional water made nesting conditions ideal. The high water came early but after over-the-water nesting began very little flooding occurred. The only real loss to diving duck production will occur when late hatched redheads and ruddy ducks fall easy prey to the hunter due to the fact that they are still learning to fly or cannot fly at all by October 6.

Breeding Population Trends

Table 1 gives the results of the 1950 ground transect data for North and South Dakota.

Although only a portion of the 1949 transects were run in 1950 in North Dakota due to flooded roads, the 26 percent increase indicated is almost exactly the same as that found by state-wide aerial and ground transects. The new transect routes laid out in 1950 (see accompanying map) were run in spite of flood waters and can be continued in the future.

Table 1. -- Ground Transect Data For The Dakotas - 1949 and 1950

	Square Miles	Water Areas		Total Ducks Per Sq. Mile		Total Pairs Per Sq. Mile		Coots Per Sq. Mile	
State	1949-50	1949	1950	1949	1950	1949	1950	1949	1950
N. Dakota	45.4	398	554	47	61	30	38	6.3	17.9
Change from '49	-		+39%		+29%		+26%		+184%
S. Dakota	53.5	407	716	82	68	37	35	13.1	18.4
Change from '49	-		+76%		— 17%		— 5%		+ 40%

Heavy snows and rains in late April and May in South Dakota created thousands of temporary water areas in the flat, agricultural land between the Leola and Waubay Hills areas and especially around the former. These water areas furnished waiting sites for lone drakes and much early nesting was accomplished. A large percentage of these nests were destroyed either by predators or by the plow. In view of the fact that no transects were located in this area the 5 percent decrease found in the Hills Areas does not represent a true picture of the entire breeding area in South

Dakota. Actually a small increase occurred over 1949. New transects laid out in 1950 include a representation of the flat country for future use.

Breaking down the data for South Dakota we find:

Waubay Hills: - 64% increase in water areas; 24% decrease in breeding pairs.
Leola Hills: - 100% increase in water areas; 43% increase in breeding pairs.

Species Composition

Table 2. -- Species Composition of Breeding Pairs

Breeding Pairs	NORTH DAKOTA 1948	1949	1950*	SOUTH DAKOTA 1948	1949	1950
Blue-winged teal	29.0	24.7	31.4	42.0	42.7	42.8
Pintail	27.1	29.6	28.8	13.9	11.7	14.7
Mallard	12.9	18.1	14.1	15.0	16.2	16.0
Gadwall	8.4	6.2	6.1	13.6	15.8	11.7
Shoveler	11.0	9.0	8.9	5.8	4.1	7.1
Redhead	3.5	3.7	2.8	3.3	2.6	2.6
Ruddy duck	2.5	2.5	2.6	3.7	3.3	3.1
Canvasback	1.6	1.9	2.7	0.6	0.7	0.5
Baldpate	2.4	2.5	1.7	1.6	1.4	0.9
Lesser scaup	1.2	1.3	0.7	0.2	1.0	0.4
All others	0.4	0.5	0.2	0.3	1.4	0.2

* Species composition based on new, 1950, transects.

The significant changes in species composition were:

1. Increase in blue-winged teal in North Dakota and a drop in mallards.
2. Increase in pintail and shoveler in South Dakota and a drop in gadwall.

Increases in teal, pintail, and shoveler may have been due to delayed spring migration causing more of these ducks to stay in the United States to nest.

The following tabulation gives an interesting breakdown of actual changes in species population. It includes data from ground transects run by Fish and Wildlife Service personnel plus data from P-R transects in North Dakota.

Table 3. -- Species Composition in North Dakota based on Total Pairs Observed along Ground Transects

Species	Total Pairs 1949	1950	Change from 1949 In Percent
Blue-winged teal	1119	1672	+ 49
Pintails	1453	1603	+ 10
Mallard	724	781	+ 8
Shoveler	487	569	+ 17
Gadwall	240	260	+ 8
Redhead	142	128	— 10
Ruddy duck	85	125	+ 47
Baldpate	98	116	+ 18
Canvasback	65	92	+ 41
Lesser scaup	82	49	— 40

All species excepting redhead and scaup showed an actual increase over 1949, but due to its numerical superiority the species which made up over 60 percent of the

increase in ducks in North Dakota was the blue-winged teal. This duck will not contribute much to the shootable surplus of ducks in the United States and practically none will be left in North Dakota by opening day.

Success of the Nesting Season

Although the majority of nesting of both waterfowl and upland game was delayed from three to four weeks due to the late spring, some pintails got started during mid-April. While the main hatch of pintails did not occur until the latter part of June there were some broods observed on July 5 which were flying. Nests of pintails which were begun in mid-April were exposed to at least three severe snowstorms which blanketed all existing cover with several inches of wet snow and several nights of sub-freezing temperatures.

Most of the ducks which nested in the temporary puddles in hay meadows and stubble fields lost their first nests and moved to the hills area for re-nesting. The ground remained too wet to plow for a prolonged period and it seemed that between late plowing and more summer fallowing than usual, plus an abnormally high skunk and badger population, production would be way off. However, when the peak of the hatch did occur (about two or three weeks late) from August 1 to 10 there were about as many or more broods than in 1949.

Table 4 includes nest success data from both North Dakota and South Dakota. Paucity of data, plus the fact that nest studies cannot be randomized, in this area at least, make the results very questionable.

Table 4. -- Nesting Data - North and South Dakota --- 1950

Species	Total Nests Found	Nests Followed Through	Destroyed or Deserted	Percent Unsuccessful	Average No. of Eggs Full Clutches Only
Mallard	20	18	16	89	9.00
Baldpate	2	2	1	50	8.00
Pintail	8	8	5	62	6.83
Blue-winged teal	18	17	11	65	10.67
Shoveler	2	2	2	100	11.00
Canvasback	8	7	5	71	9.00
Redhead	5	4	4	100	11.00
All Species	63	58	44	76	

The fate of the 44 unsuccessful nests was: 17 destroyed by skunk; 14 deserted; 4 destroyed by crows; 1 by badger; 1 by mowing; 6 by undetermined predators; and 1 was a dump nest.

The 25 percent success ratio is probably much lower than actual nesting success due to the following reasons:

1. Human disturbance which may cause some desertion after a nest is found.
2. Nest hunting was not done in growing grain where nesting cover was at its best due to the large uninterrupted area of cover afforded.
3. Nests found may also be the easiest for the predators to find.

Brood Survival

A better index to nesting success is the number of broods produced in comparison to nesting pairs found on transects. There are two methods which can

be used: (1) A direct comparison between broods per square mile and pairs per square mile on identical transects; and (2) A comparison between species composition of broods and of pairs. Both methods give only an index to relative productivity from one year to another.

In both of the Dakotas certain transects were covered five times in order to arrive at as accurate a breeding pair and brood population as possible and also to measure changes in the lone drake and pair ratio during the nesting season. Only in South Dakota was this type of coverage made in 1949. Results are shown in Table 5.

Table 5. -- Breeding Pair and Brood Production --- 1949 and 1950 Transects - C, D, and E; South Dakota

	Number of Pairs		Number of Broods			
	May 4-5	May 16-17	July 27	Aug. 8	Pairs per Brood	
Species	1949	1950	1949	1950	1949	1950
B-w. teal	535	425	90	78	5.94	5.45
Mallard	156	129	16	13	9.75	9.92
Pintail	43	57	4	12	10.75	4.75
Gadwall	219	126	25	10	8.76	12.60
Shoveler	36	21	3	2	12.00	10.50
Redhead	41	26	3	6	13.67	4.33
Ruddy duck	44	47	-	4	---	11.75
Baldpate	14	3	1	2	14.00	1.50
All others	31	16	6	2	5.17	8.00
Total	1119	850	148	129	7.56	6.59

Another way of expressing this success ratio is by way of a formula:

$$\frac{\text{Number of broods per square mile} \times \text{Average number per brood}}{\text{Number of pairs per square mile seen on spring transects}} = \text{Index to success.}$$

Applying the above formula to 1949 and 1950 data on Transects C. D. & E, in South Dakota, we find:

1949: $\frac{6.46 \times 7.61 \text{ (over number per brood; all species)}}{48.86} = 1.006$

1950: $\frac{5.63 \times 6.90 \text{ (over number per brood; all species)}}{37.12} = 1.046 \pm 4\%$

Thus we find from the fore-going Table 5 and from the formula that although there were actually fewer pairs and broods counted in 1950 than in 1949 the success of nesting pairs was indicated to be greater in 1950. In other words, the production of ducklings per pair was greater in 1950 than it was in 1949. This was in the Waubay Hills area only. The formula takes into consideration brood sizes, which was not the case in Table 5. Due to a smaller brood average in 1950 the table indicates even better success per pair than the formula.

Applying the formula to data from the Leola Hills of South Dakota we find the following:

July 12, 1949 - $\frac{2.89 \times 8.02}{29.67} = 0.78$ July 24, 1950 - $\frac{3.17 \times 7.73}{43.33} = 0.56$

This data indicates poorer success in 1950 if the dates are phenologically the same. However, neither brood count was taken during the peak of the hatch. There are unquestionably too few data (especially brood data) included in the above table and formulae to make the indices absolutely accurate. However, brood transects are now set up in North and South Dakota which should give adequate data in the future.

The second method of measuring brood survival is one which compares the success of one species with another by comparing species composition. Table 6 illustrates this method.

Table 6. -- Species Percentage Composition - Breeding Pairs vs Broods

Species	South Dakota Transects C, D, E, & K			North Dakota Transects 1, 4, 6, 8, & 12		
	Breeding Pairs	Broods	Total No. of Ducklings	Breeding Pairs	Broods	Total No. of Ducklings
	Percent	Percent	Percent	Percent	Percent	Percent
B-w. teal	41.8	55.1	59.4	30.4	46.4	49.6
Pintail	12.9	13.7	9.6	27.8	13.0	9.7
Mallard	15.8	10.0	9.3	14.0	10.4	9.0
Gadwall	12.7	8.3	9.8	7.1	10.4	12.0
Shoveler	6.2	2.9	3.2	8.7	7.0	7.4
Redhead	4.0	4.0	3.4	3.3	1.8	1.9
Ruddy duck	2.7	2.9	3.3	3.7	3.4	2.6
Baldpate	1.3	1.1	0.9	2.1	2.2	2.2
Canvasback	1.2	0.6	0.2	2.0	2.4	1.8
Lesser scaup	1.0	1.4	0.9	0.7	3.0	3.8

The data in Table 6 merely indicate the comparative breeding success between species. They show, for example, that in South Dakota the blue-winged teal and ruddy duck were the only two species which increased in comparative abundance between the nesting and brooding season. Considering the number of broods produced, the pintail and redhead were also quite successful. This compares favorably with brood success as indicated in Table 5.

In North Dakota, according to Table 6, the blue-winged teal and gadwall were the most successful breeders. The method used in Table 6 to determine production is only relative and there is some chance for error. Pintail production is probably a bit better than indicated. Early hatched broods are kept in heavy cover in temporarily flooded meadows and so may be not all recorded. Later on, these areas dry up and force most ducklings to more open areas where observation is possible. By this time, however, some pintail broods can fly and are missed entirely.

Brood Averages

Over 2,000 broods were recorded in the Dakotas of which 1,936 were considered to be complete broods and were accurately counted. Brood counts were made on and off of Transects from June 18 to August 29 in 1950.

Table 6. -- Brood Averages By Age Classes

Species		1	11	111	All	Total Broods Counted
Blue-winged teal	1949	8.60	7.76	7.54	8.11	577
	1950	8.21	7.75	7.37	7.80	850
Pintail	1949	5.69	4.97	5.69	5.50	133
	1950	5.20	5.52	5.93	5.70	331
Gadwall	1949	7.86	7.27	7.40	7.67	153
	1950	7.91	7.81	8.29	7.94	218
Mallard	1949	6.97	6.77	6.67	6.82	130
	1950	7.05	7.00	6.25	6.80	193
Shoveler	1949	7.13	6.43	6.54	6.79	62
	1950	7.98	7.00	7.31	7.57	116
Ruddy duck	1949	6.20	5.50	6.50	6.13	38
	1950	6.61	4.83	5.00	6.22	67
Redhead	1949	7.00	6.50	6.25	6.72	29
	1950	7.00	7.40	----	7.08	50
Canvasback	1949	6.93	4.20	6.64	5.32	34
	1950	4.25	5.64	6.20	5.22	46
Baldpate	1949	6.71	7.11	7.66	6.96	26
	1950	7.24	6.50	5.50	7.15	33
Lesser scaup	1949	9.60	6.00	----	7.50	16
	1950	7.77	8.45	7.00	7.97	31
All Species	1949	7.79	7.03	6.97	7.40	1198
	1950	7.47	7.21	6.83	7.20	1936
Total Number of broods	1949	610	289	299	1198	
	1950	857	420	659	1936	

Only in the case of the teal were there enough broods counted to warrant a comparison between states. Note how closely the brood averages agree between North and South Dakota in the following tabulation.

	Blue-winged Teal			
	1	11	111	All
North Dakota	8.41 (160)	7.68 (102)	7.33 (174)	7.81 (436)*
South Dakota	8.04 (182)	7.81 (108)	7.43 (124)	7.80 (414)*

* Numbers in parenthesis indicate number of broods counted.

The fore-going Table indicates that for all species brood averages were a bit higher in 1949 but a larger proportion of Class 111 broods were counted in 1950. Actually, the only true comparison is between Class 1 and Class 111 broods. Using Class 111 broods only, we find a difference of about 0.14 ducklings per brood between 1949 and 1950, or a loss of 2 percent. It is likely, however, that no waterfowl census can be accurate enough to measure this small a percentage change.

Summer Banding Operations - South Dakota, 1950

Due to the lateness of the hatch and the importance of obtaining as much brood data as possible, banding operations were delayed until August 14. Although numerous broods were caught which were too small to band, most of the ducks of the year had reached flying age. Weather conditions made the period of August 14 to 25 a miserable time in which to band ducks. Results are included in the following table:

Sex and Age of Ducks Banded in South Dakota - 1950

Species	Adult Males	Adult Female	Total Adult	Local Males	Local Female	Total Local	Grand Total	Ratio* Males: Females
B-w. teal	4	26	30	264	232	496	526	53:47
Shoveler	1	1	2	30	35	65	68**	47:53
Pintail	-	-	-	35	23	58	58	60:40
Mallard	-	1	1	20	18	38	39	53:47
Gadwall	-	-	-	19	12	31	32**	61:39
Redhead	-	-	-	12	11	23	23	52:48
Lesser scaup	2	-	2	8	5	13	15	61:39
Baldpate	-	-	-	6	2	8	8	75:25
Ruddy duck	1	-	1	4	3	7	8	57:43
Canvasback	-	-	-	3	2	5	5	60:40
Totals	8	28	36	401	343	744	782	54:46

* Ratio based only on juvenile (locally raised) ducks.
** One duckling was not sexed.

Location of banding was as follows:

Species	Leola Hills	NW Brown County	Waubay Hills
Mallard	25	1	13
Gadwall	17	10	5
Baldpate	8	-	-
Pintail	45	10	3
Blue-winged teal	378	48	100
Shoveler	53	7	8
Redhead	10	2	11
Canvasback	5	-	-
Lesser scaup	11	-	4
Ruddy duck	7	1	-
Total ducks	559	79	144
Coot	37	-	3

Summary

Breeding Population: - The number of breeding pairs, as measured by ground transect, indicated an increase in North Dakota of 25 percent over 1949. In South Dakota the raw data indicated a 5 percent decrease, but further analysis of all existing data, plus additional transects run in 1950, indicated a small increase of about 10 percent.

Species Composition: - Relative abundance of breeding pairs changed to some extent in 1950, probably due to the delayed migration. Blue-winged teal increased considerably in North Dakota, while mallards increased only slightly and dropped in relative abundance. In South Dakota, pintail and shoveler showed increases in 1950 while gadwall decreased.

Nesting Success: - Nesting was delayed in most species for from two to three weeks. Loss to first nests was again extremely high, with the main causes of nest loss due to agricultural operations with predation also a very important factor.

Brood Survival: - Production of broods was quite satisfactory as compared to 1949. In areas where there was a large increase in breeding pairs, brood production did not quite keep pace with this increase. However, the over-all production was unquestionably somewhat higher in 1950 than in 1949.

Brood Averages: - Brood averages were very much the same as in 1949 with only a small decrease of about 2 percent in brood sizes between Class 111 broods of all species. This percentage is too small to be significant.

Conclusions: - An increase in breeding stock was subjected to the usual heavy nest mortality and while more broods were produced than in 1949 the survival index is believed to be under that of 1949. Blue-winged teal made up most of the increase in breeding pairs and broods.

WATERFOWL BREEDING GROUND SURVEY IN COLORADO, 1950

Willard L. Flinn

Introduction

The 1950 waterfowl breeding ground study was conducted in the San Luis Valley and the South Platte River Valley, and the same methods and techniques were employed by the same men as in 1949. Aerial census of the San Luis Valley was also repeated to give a three-year comparison record.

Techniques

Ground work in the San Luis Valley was an intensive survey of selected nesting areas to determine total production by species and cover type, and decimating factors affecting production. Sample areas were selected on the basis of natural vegetation, water distribution, and general land use including crop production and grazing. Production was determined by periodical counts of nesting pairs, nests, and broods on the sample area. Ronald A. Ryder is credited with the work and data obtained from the San Luis Valley.

The South Platte River Valley study was divided into two parts. An extensive survey of 1,200 square miles was made, of which every twentieth Section was covered once, noting nesting pairs, broods, and lone birds, and where it was possible, by species. A smaller area of irrigated farm land, Township 7 N, R68W, 6th Prime Meridian, was systematically covered six times during the period between June 13 and August 21. It is believed that data obtained is relative to very nearly the total waterfowl production of the sample area. This study is credited to Jack R. Grieb, Colorado Cooperative Wildlife Research Unit, Colorado A. & M. College.

The aerial work in the San Luis Valley was done during the latter part of June, at a time when it was believed that most broods were present. The area was arbitrarily outlined and divided into five parts, each having characteristic habitat and land use; the total having an area of 1,484.5 square miles. Transects were flown to cover approximately 4.3 percent of the farm and meadow land (1,310 square miles) and total counts were made on the remaining 174 square miles. Information obtained by aerial census is credited to Kenneth B. Milyard and Clyde Matteson.

Weather

These areas of Colorado, where waterfowl breeding studies were conducted, were dry during the breeding season as compared with 1949, and probably were drier than normal. Many small water holes, usually providing good nesting cover, were dry or drastically reduced. The total acreage of surface water in the San Luis Valley was considerably less than last season, probably causing a concentration of ducks on the permanent bodies of water, such as the Russell Lakes study area. The same may be said for the South Platte Valley, where most of the available nesting area was confined to a strip near the river.

Findings

San Luis Valley Study Area

Nesting pairs were much more abundant on the study areas than last year. This season, final data for 370 mallard nests (2,599 eggs) was obtained, as compared

with 266 mallard nests (1,573 eggs) in 1949. Sixteen non-mallard were under observation in 1949, as compared with thirteen this year. The average clutch size of 8.28 eggs was approximately the same as last year. It is interesting to note that of the eggs that failed to hatch, 33.4 percent of 1,993 mallard eggs were destroyed by predators as compared with 18.9 percent of 996 eggs in 1949. Along with the greater concentration of ducks and nests, there also appeared to be an increased predator population on the study area, principally skunks and magpies.

In 1950, an average brood count of 7.4 young was obtained from 148 mallard nests known to have hatched, entirely or partially, and this is substantially lower than the 7.9 average obtained for 86 nests in 1949. Considering the 270 nests attempted, for which the final fate of the eggs is reasonably certain, the average number of young per hen was only 4.0 in 1950 as compared with 4.4 in 1949. For both years, actual brood counts indicated average broods somewhat lower than those derived from nest evidence. It appears, then, that in 1950, not only were the initial broods smaller than those of 1949, but a greater loss of young ducklings was suffered following the hatch.

South Platte River Valley

The South Platte studies were confined to irrigated farm land and river bottom types for a distance of 175 miles along the valley. This 1,407 square-mile area was sampled in a randomized manner, the sample amounting to 4.28 percent (51 square miles) of the farm land and 8.84 percent (19.4 square miles) of the river bottom. The farm land production is calculated to have produced 3.77 young ducks per square mile in the sample areas as compared with 5.06 in 1949, or a decrease of more than 25 percent; and an average brood size of 5.81 as compared with 5.18 in 1949. River bottom land surveys indicated that 7.73 young were produced per square mile, as compared with 7.58 in 1949; and 5.65 young per brood as compared with 4.83 in 1949. The data obtained is relative to all species of ducks, but mallards are predominant, making up more than 85 percent of all ducks in the entire area. This is somewhat higher than the 68.3 percent of mallards found in the valley last year.

The study township produced these data: 81 broods with 466 ducklings, averaging 5.75 young per brood and 12.95 birds per square mile. This is thought to be the total production this year after having completely covered the area six times during the season. It is interesting to note that only 39.51 percent of the total broods produced were seen at any one coverage. It may be possible, therefore, to derive a conversion factor which in turn could be applied to larger areas to determine populations or production by a single coverage.

Aerial Census

The aerial census revealed 100 broods with 522 young ducks averaging 5.22 birds per brood in the San Luis Valley. This is compared with 57 broods counted in 1949, averaging 6.2 young per brood.

The total adult population was about the same this year as last, the production increased from .24 to .43 young per square mile.

Migration

The extremely mild winter of 1949-50 permitted a wider use of water areas in Colorado early this spring than occurred in the preceding year, resulting in what seemed to be a less distinct migration of waterfowl. Flights of mallards, pintails, and baldpates apparently passed through in a much more leisurely fashion, extending over a longer period of time. The reduction of total water surface may offer a partial explanation. The numbers of migrating divers observed in April

and May was considerably less this year, which may be due to the peak of their migration coming earlier.

Summary

Although most of the information on duck production in Colorado would appear to show an increase this year over last, it is believed that on the whole production is little greater because of reduced available water. The resulting crowded and concentrated conditions seem responsible for less successful nesting and an increase in predator activity.

Waterfowl Banding

Waterfowl trapping and banding operations during the summer were confined to the San Luis Valley where a total of 817 waterfowl were banded between July 1 and August 31. Of the 817 banded, 788 were mallards.

Species	Male	Female	Total
Mallard	148	640	788
Pintail	10	9	19
Gadwall	3	2	5
Baldpate	--	1	1
Shoveler	--	1	1
G-w. teal	1	--	1
Coot	2	--	2
Total	164	653	817

Although still limited in numbers, band returns indicate Colorado harvested the greatest percent of waterfowl produced in the San Luis Valley in 1949. Returns of 1950 bands should help to clarify this indication. A few returns in the summer of 1950 may indicate that a large part of 1949 summer residents return or remain on or near the nesting grounds.

WATERFOWL BREEDING GROUND SURVEY IN NEBRASKA, 1950

John H. Wampole

Introduction

In setting up survey routes in 1948 it was recognized that many uncontrolled factors could affect the usefulness of any data obtained by whatever methods were used. Therefore, the purposes of the survey in Nebraska have for three seasons been (1) to evaluate the seasonal and year by year trends in duck population on a qualitative rather than a quantitative basis, and (2) to test the methods used. By qualitative rather than quantitative is meant that, although the data shown in the tables is considered to be the best that could be obtained under the existing conditions, there is no claim for statistical accuracy and no attempt is made to estimate or calculate total production. The data is to be considered as indicative of a trend only.

Although it is known that ducks are produced in other areas of the State, survey activities were limited to the Sandhills which include roughly two hundred square miles of Nebraska from the State boundary on the north to the Platte River on the south, and from Alliance on the west to Stuart on the east. The Sandhills are believed to contain the most productive of the water areas of the State. Both ground and aerial routes were set up.

Methods Used and Area Covered

Ground Coverage

In 1948 three routes (A, B, and D) totaling 39 square miles were established in the western Sandhills, and Route C (12 square miles) in the eastern Sandhills. These routes with exceptions noted later in the report were run by Game Commission personnel (Hytrek and Wampole) and U. S. Game Agent, Paul S. Smith during the 1948, 1949, and 1950 seasons. In 1949 another route of 3 1/4 square miles was set up by J. H. Sather, Nebraska Game Commission Biologist, and run incidental to his muskrat investigations in the eastern Sandhills south of Valentine. In 1950 another ground route was established in the Clay-Fillmore area of fresh-water ponds by Biologist Levi L. Mohler, and George Schildman. Data from the two more recently established routes is to be found in the PR Quarterly Report but will not be included in this report because of the lack of directly comparable trend data.

Aerial Coverage

G. K. Larson, B. M. Taylor, and R. H. Macomber of the Missouri River Basin Surveys (Grand Island Office) set up an aerial route of 29 1/4 square miles in 1949 in that area of the eastern Sandhills south of Valentine between the Niobrara and Loup Rivers. May counts were made in 1949 and 1950, and a July count in 1950.

In 1948, after preliminary flights, Nebraska Game Supervisor L. P. Vance, and Conservation Officer A. O. Edmunds set up in 1949 an aerial route of 29 1/3 miles in the eastern Sandhills. This route, known as the Lazy S, was run in May and June of 1949 and 1950. Extension of aerial coverage westward was begun in 1950.

The 1/4 mile transect method was used on both aerial and ground routes. Spot samples of individual water areas were studied during the 1950 season.

The ground coverage in the Sandhills is hampered by the topography and the unimproved Sandhill trails. The water areas vary from very small, usually

temporary areas, to marshy ones of several square miles in extent. There are some lakes that are highly alkaline and with relatively sparse cover. Nearly every transect mile includes or borders on a water area until the usual summer dry-up of July and August.

In recording data, the figures for pairs include lone males assumed to be territorial and representing pairs. In total numbers, however, lone males count as singles.

A 10-square-mile sample of Route B was used during the three seasons covered by this report as a basis for the July brood counts that were sent to the U. S. Fish and Wildlife Service Regional Office.

Weather and Water Conditions

Generally, the Nebraska Sandhills are in a region of fluctuating water conditions during each breeding season and from year to year. The frequency of local thunder storms and the areas covered by them influences the water supply and the movements of the ducks. During the three seasons under discussion water levels remained up until mid-June. During the summer of 1949 the exception for the three seasons, levels remained up all summer. This is readily explained by the great amount of 1948-1949 winter snow and the spring rains of 1949. In the eastern Sandhills excessive amounts of water prevented travel in June over many areas. Conditions in 1950 in the western Sandhills were similar to those of 1948, near drought in some spots and good water levels in others, with the usual mid-summer drying. Conditions in the eastern part were much better but without the extremely high levels as in 1949. The tables to be discussed indicate a trend in the observed duck production that is correlated with the changes in weather and water conditions.

Data Collected

June Counts

Preliminary counts in 1948 indicated (1) that prior to mid-June a high percent of the ducks observed were migrants and (2) that numbers leveled off to what could be considered as the breeding population by that time. Data from the June counts (Table 1) indicate for the western Sandhills an increase in 1949 of breeding pairs and a decrease in 1950. The data for the eastern Sandhills is incomplete since no comparable figures are available for June 1949. It is to be noted that the number of ducks observed per square mile does not follow the same trend as does the number of pairs. It seems that there may be a considerable number of non-breeders in the summer population.

The aerial counts made by Vance and Edmunds along the Lazy S Route of 29 1/3 square miles showed the following results: June 10, 1949 - 644 ducks; June 13, 1950, - 641 ducks; amounting to an observed 21 birds per square mile of sample, or, no change indicated in observed numbers.

July Brood Counts

It appears from brood counts (Table 2) that the fluctuations of the trend in brood occurrence, upward in 1949 and downward in 1950, were less pronounced in the eastern Sandhills where water conditions were more stable than they were in the western areas where noticeable fluctuations occurred during the three-season period.

The average size of broods observed (Table 2, Young Per Brood) appears not to have varied much over the three-season period, but to have been slightly higher

in the eastern areas, particularly in 1949. The average for the Sandhills was 7 birds per brood each season, so far as the sample counts indicated.

Based on July counts of brood occurrence (Table 4) blue-winged teal is the number one nester in the Sandhills. Mallard, pintail, redhead, and ruddy seem to be important nesters.

Nesting Success

No trend data for nesting success is available. Table 5 shows the results of observations on 37 duck nests comprising 6 species and 26 coot nests on three areas. It is obvious that nest destruction was high in the Sandhills under 1950 conditions. However, the fact that broods were seen on the areas of high nest destruction indicates the likelihood that it is a common occurrence each season and may not necessarily be the limiting factor in nesting success.

Summer Banding

The following ducks were banded between August 19 and September 9, 1950:

Mallard -- 24 adult males, 39 juvenile males, 5 adult females, 19 juvenile females, and 2 unclassed.

Pintail -- 5 juvenile males, 1 juvenile female.

Blue-winged teal -- 1 adult male, 32 juvenile males, 21 juvenile females, and 2 unclassed.

Green-winged teal -- 1 juvenile male.

A total of 152 ducks were banded.

Discussion

The data from three seasons of breeding ground survey indicate the trend of breeding stock and brood occurrence in the areas sampled. The ratio of observed broods to breeding pairs (Table 3) did not vary with regard to eastern or western areas. However, it appears that nesting success in the western Sandhills during 1949 was the highest of the three seasons, since the ratio is one brood to 5 pairs as compared to 1 to .14, and 1 to 10 for 1948 and 1950, respectively. The high ratio of observed pairs to broods may be accounted for partly by a high incidence of nest destruction and partly by the difficulty of seeing broods in the areas of relatively dense emergent vegetation. The trends are consistent through the three seasons.

Summary

This report deals with the record of observations in the Nebraska Sandhills during the waterfowl breeding seasons of 1948, 1949, and 1950. The purposes of the survey were (1) to evaluate the seasonal and yearly trends in waterfowl populations on a qualitative rather than a quantitative basis, and (2) to test the methods used.

The transect (1/4-mile) method was used in ground and aerial coverage. Game Commission personnel and U. S. Game Agent Paul S. Smith made the ground counts upon which most of this report is based. Aerial counts were made by personnel of the Grand Island Office of the Missouri River Basin Studies and by State Game Supervisor L. P. Vance and Conservation Officer A. O. Edmunds. Not enough data is available to determine a trend from the aerial observations.

The 1948-1949 blizzard was conducive to unusually wet conditions in the Sandhills during the 1949 season in contrast to what appears to be the usual fluctuating moisture conditions as found in 1948 and 1950. The counts of breeding pairs in June and brood counts in July during the three seasons appear to show a trend correlated with the water conditions.

The average brood size was seven birds at the time of observation. No trend data are available for nesting success or brood rearing. The record for 37 duck nests and 26 coot nests in 1950 indicates a high rate of nest destruction. However, broods were seen later in the season on areas of high nest destruction, indicating the likelihood that the destruction may not have been the limiting factor.

The blue-winged teal is the number one nester in the Sandhills according to the data obtained. Mallard, pintail, redhead, and ruddy are important nesters.

A total of 152 ducks were banded at the Spring Lake Banding Station during the August 19 - September 9 period. One brood of flightless mallards was included. Mallard (89), pintail (6), blue-winged teal (56), and green-winged teal (1) were the species banded.

Table 1. -- Sample Counts of Breeding Stock in the Sandhills

	WESTERN			EASTERN		
	6/11 & 14 1948	6/8, 9, & 14, 1949	6/5, 9, 12, & 13, 1950	6/17 1948	1949[2]	6/7 1950
Sample (Sq. Mi.)[1]	37.25	35	39	12	---	9.4
Number of Birds	1397	1150	1186	612	---	293
Number of Pairs	602	722	587	301	---	205
Birds per Sq. Mi.	37	33	30	51	---	31
Pairs per Sq. Mi.	16	20	15	25	---	22

[1] The sample used for June counts included more mileage and square mileage than did the sample used for July brood counts in the western Sandhills. In the eastern Sandhills high water prevented completion of the route in 1950.

[2] Because of flood waters of the Elkhorn the eastern route was not covered in June, 1949.

Table 2. -- The Trend in Brood Occurrence as Shown by July Brood Counts

Date of Count	Sample (Sq. mi.)	No. of Broods	No. of Young	Young Per Brood	Broods / Sq. Mi.	Young / Sq. Mi.	Percent Change
			WESTERN SANDHILLS[1]				
July 6-9, 1948	33	40	272	7	1.2	8	
July 14, 1949	10	42	269	6	4.2	27	228% inc.
July 14-20, 1950	33	53	332	6	1.6	10	63% dec.
			EASTERN SANDHILLS[2]				
July 12, 1948	12	20	153	7	1.7	13	
July 11, 12, 1949	12	32	250	8	2.7	21	62% inc.
July 25, 1950	12	26	193	7	2.2	16	23% dec.
			SANDHILLS[3]				
July 6-12, 1948	45	60	425	7	1.3	9	
July 11-14, 1949	22	74	519	7	3.4	23	151% inc.
July 14-25, 1950	45	79	525	7	1.8	11	48% dec.

[1] The 33 square mile sample includes Route A, the 10 square mile part of Route B used as a basis for reporting brood occurrence to the Fish and Wildlife Service, and Route D.

[2] Counts for the eastern Sandhills are based on the 12 square mile sample known as Route C.

[3] The Data for the eastern and western Sandhills were combined to produce the tabular estimate of the trend for the Sandhills.

Table 3. -- The Ratio of Observed Broods to Breeding Pairs

	WESTERN			EASTERN		
	1948	1949	1950	1948	1949	1950
Pairs per Square Mile [1]	16	20	15	25	---	22
Broods per Square Mile [2]	1.2	4.2	1.6	1.7	---	2.2
Pairs Required to Produce one Brood	13	5	9	14	---	10

[1] From Table 1.
[2] From Table 2.

Table 4. -- The Species Composition of Observed Broods

WESTERN	BROODS			DUCKLINGS			AVERAGE		
Species	1948	1949	1950	1948	1949	1950	1948	1949	1950
Mallard	6	7	12	43	44	78	7	6	6
Gadwall	1	3	-	8	21	-	8	7	-
Baldpate	1	-	-	7	-	-	7	-	-
Pintail	6	4	3	40	27	21	7	7	7
Blue-winged teal	13	10	12	97	59	71	7	6	6
Shoveler	-	-	1	-	-	3	-	-	3
Redhead	3	13	9	15	78	67	5	6	7
Canvasback	-	-	3	-	-	19	-	-	6
Ruddy	6	3	9	32	22	56	5	7	6
Unidentified	4	2	4	30	18	17	7	9	4
Totals	40	42	53	272	269	332	7	6	6

EASTERN	BROODS			DUCKLINGS			AVERAGE		
Species	1948	1949	1950	1948	1949	1950	1948	1949	1950
Mallard	5	9	7	40	73	46	8	8	7
Gadwall	-	-	-	-	-	-	-	-	-
Baldpate	1	-	-	7	-	-	7	-	-
Pintail	7	8	5	50	53	24	7	7	5
Blue-winged teal	6	15	14	54	124	123	9	8	9
Shoveler	-	-	-	-	-	-	-	-	-
Redhead	-	-	-	-	-	-	-	-	-
Canvasback	-	-	-	-	-	-	-	-	-
Ruddy	1	-	-	2	-	-	2	-	-
Unidentified	-	-	-	-	-	-	-	-	-
Totals	20	32	26	153	250	193	7	8	7

Table 5. -- Nesting Success of Ducks and Coots in the Sandhills - 1950

Species	Total Nests	Nests Hatched	Nests Deserted	Nests Destroyed by				Total Eggs	Eggs Per Nest	Eggs Hatched	Eggs Left in Nest
				Mammal	Bird	Farm Operations	Unknown Cause*				
Mallard	10	2	0	3	4	0	1	102	10	15	3
Pintail	1	0	0	0	0	0	1	3	3	0	0
Blue-winged teal	19	4	6 **	1	1	2	5	123	7	40	11
Shoveler	2	0	0	1	0	0	1	17	8	0	0
Redhead	3	0	1	0	1	0	1	12	4	0	2
Ruddy	2	1	0	1	0	0	0	13	6	8	0
Totals	37	7	7	6	6	2	9	270		63	16
Coot	26	12	0	0	0	0	1	208	8	110	1

* Some of these nests were found to be empty and the eggs may have hatched, no trace remaining because of scavenging. Bull snakes are considered a likely predator accounting for some unknowns.

** Included are three nests discovered before the start of egg laying.

AERIAL WATERFOWL BREEDING GROUND SURVEYS IN NORTH DAKOTA, SOUTH DAKOTA, AND NEBRASKA, 1950

Edward G. Wellein

Since 1946, annual spring aerial surveys have been conducted in North Dakota for the purpose of evaluating the waterfowl breeding population. In 1948 these surveys were extended to include South Dakota and Nebraska. Each year the surveys were conducted during the middle of May and this year, accordingly, the survey work was begun on May 16. A Grumman Widgeon aircraft was used in the survey work this year, but in previous surveys a Piper Cub J 5 C was used. Mr. Rae Sjostrom, U. S. Game Management Agent, assisted as observer in the 1950 survey.

The objective of this report is to present a sketch of the waterfowl breeding situation in North Dakota, South Dakota, and Nebraska as judged by the data collected in the course of the survey work.

Original plans called for the abandonment of the nine transects which had been in use since 1946 (and which were located principally in the better waterfowl habitat) for a better system of transects arranged east and west across the States of North Dakota and South Dakota. However, it was finally decided to fly the original nine transects again this year in addition to the new ones to learn more concerning the influence of the distribution of water areas on waterfowl populations.

The spring was undoubtedly the latest recorded in the past 50 years. North Dakota and South Dakota were plagued by a series of blizzards and snow storms which occurred in late April and early May, after migration had begun. As a result, the birds piled up against the winter front in South Dakota and Nebraska for an unusually long period of time, thus creating the illusion "that we have more ducks than we ever had before." This situation did not change until about May 10, when weather conditions began to improve in the North and the birds moved on.

Because of the excessive and late run-off, water was present in the flat farming country which would ordinarily be dry at this time of the year. As a result, ducks were as widely distributed as the water. Farming operations were greatly delayed and crops adversely affected.

The data incorporated in this report is separated into two parts: Those obtained from the original transects and those obtained on the state-wide transects.

The data from the older transects based on ducks per square mile are shown for years 1946 through 1950 in Table 1. The species composition for three years is recorded in Table 2.

Table 1. -- Breeding Population Index

Transect No.	No. Square Miles	Ducks per square mile 1946	1947	1948	1949	1950
1	39.2	13.3	9.5	23.5	32.8	31.9
2	16.7	11.4	8.0	22.1	36.6	26.0
3	43.7	17.2	18.6	27.6	36.2	40.5
4	29.7	11.9	10.3	32.5	37.2	29.6
5	21.5	23.5	16.2	22.6	43.5	41.5
6	29.4			31.2	25.5	29.7
7	21.2			20.2	31.9	22.5
8	21.5			19.4	46.6	23.1
9				20.6	29.3	33.0
Average		15.4	13.1	24.4	35.4	31.7

Table 2. -- Species Composition, Summation Transects 1 through 9

Species	Comparative abundance, percent 1948	1949	1950
Pintail	28.6	26.8	20.1
Blue-winged teal	21.7	25.6	27.7
Shoveler	10.2	10.1	6.7
Mallard	14.0	16.5	24.3
Scaup	3.5	2.6	3.4
Baldpate	2.0	1.4	1.2
Gadwall	11.5	8.7	9.5
Redhead	4.8	3.3	2.5
Canvasback	1.8	1.6	2.3
Ruddy	1.5	2.7	1.6
Green-winged teal	.4	.3	.3
Ringneck			.2
Bufflehead			.1

These data for this tri-state area as a whole indicate a decrease of approximately 10 percent over last year in this area. The pintail was responsible for the largest portion of the decrease.

The transects which were established this year consist of four one-fourth mile wide transects 48 miles apart extending east and west across the State of South Dakota and four similarly arranged across the State of North Dakota. Aside from the fact that far better sampling could be accomplished by this system, the objectives behind this arrangement were twofold:

1. A framework was established from which reliable population information could be obtained for the entire area regardless of the annual variations in water distribution.

2. It was desirable to obtain comparable information on the efficiency and accuracy between transects covering a one-fourth mile strip and those covering a one-half mile strip.

Approximately 30 hours of flying time was required for this project with a resultant coverage of over twice that of the old system.

The data obtained on the state-wide transects are as follows:

Table 3. -- Number of ducks, coots, and water areas on transects in North Dakota, and South Dakota, east and west of the Missouri River.

North Dakota

Transect No.**	No. sq. mi.	East of Missouri			West of Missouri		
		Ducks	Coots	Water A.	Ducks	Coots	Water Areas
3	79.5	1970	161	1071	*	-	
7	82.5	2024	249	992	18	-	18
11	86.2	1063	104	980	194	-	104
15	87.7	1038	27	997	125	-	131
Total	335.9	6095	541	4040	337	-	253

* Transect No. 3 does not cross Missouri River.
** Numbered according to system used by North Dakota.

South Dakota

Transect No.	No. sq. mi.	East of Missouri			West of Missouri		
		Ducks	Coots	Water A.	Ducks	Coots	Water Areas
1	88.5	767	68	514	213	1	143
2	93.9	553	32	335	138		108
3	95.4	204	1	179	227	3	145
4	95.2	192	29	204	106		132
Total	373.0	1716	130	1232	684	4	528

Table 4. -- Number of ducks and water areas per square mile of transects in North and South Dakota

North Dakota *

Transect No. **	Ducks per sq. mile	Water areas per sq. mile
3	24.8	13.5
7	24.7	12.2
11	14.6	12.6
15	13.3	12.9
Average	19.1	12.8

* These data were submitted to the North Dakota P-R staff for inclusion in their waterfowl data.
** Numbered according to system used by North Dakota.

Table 4. -- (continued)

South Dakota		
Transect No.	Ducks per sq. mile	Water areas per sq. mile
1	11.1	7.4
2	7.5	4.7
3	5.6	3.4
4	3.1	3.5
Average	6.4	4.7

Table 5. -- Breeding population indices for North Dakota and South Dakota

State	Total square miles	Total Number Ducks	
		Uncorrected	Corrected *
North Dakota	70,665	1,349,700	1,799,600
South Dakota	77,047	493,100	657,470
Total	147,712	1,842,800	2,457,070

* Computed on assumption only 75 percent of birds observed.

Allowing for a minus 25 percent error, the corrected number of ducks per square mile for North Dakota would be 25.5; for South Dakota, 8.5. This would indicate that North Dakota had almost three times as many ducks and 2.7 times as many water areas as South Dakota. The number of ducks per water area in North Dakota was 1.5; South Dakota, 1.4.

As usual, there is only a rough correlation between number of water areas and number of ducks. Water, of course, is basic to waterfowl distribution and yet other factors obviously are present. It is quite possible that water distribution the previous July might correlate more closely with the spring breeding population.

Summary

Nine transects which had been in use since 1946 in Nebraska and the Dakotas were again flown in 1950. The findings indicated a significant increase in water areas but also a decrease in ducks per square mile. The recorded decrease in ducks on these established transects was likely occasioned to some extent by both the timing of the inventory in relation to the migration and the greater availability of water areas in those sections of the States not covered by the transects and which normally are not considered attractive breeding habitat.

The older transects thus did not adequately reflect conditions outside of the better sections in this year of water abundance. While it was felt that in most years these transects would provide satisfactory indices, it was, nevertheless, considered desirable to establish new transects which would be more reliable under varying conditions caused by seasonal differences in water distribution and weather. State-wide transects were, therefore, undertaken and will provide data which can be used for comparison in future years.

WATERFOWL BREEDING GROUND SURVEY IN MINNESOTA - 1950

Forrest B. Lee

Weather and Water Conditions and Account of Spring Migration

The spring of 1950, as a whole, was decidedly cooler and much wetter than usual. According to U. S. Weather Bureau records, the average precipitation for the spring months (March, April, and May) was 2.51 inches more than the mean for the past 60 years, and it was the coolest spring since the Climatological Service was established in 1891.

Game wardens and area game managers tallied waterfowl observations throughout the spring months. These data are summarized in Table 1. The first ducks of the season were seen in the prairie counties of west central and southern parts of the State (Areas 1X, X, X1) during the week of March 6 - 12. There was some open water there at this time, but freezing weather followed and these mallards and pintails appeared to move back south out of the State. Ducks appeared again in these areas after the 20th of March when there was some open water in the fields. The peak in numbers of migrating ducks was during the first week of April in the southern counties and about a week later in the west central counties (Areas V and 1X). Lakes in southern Minnesota were not free of ice until the middle of April, and in the west central counties the final break-up was the last week of April or the first days of May.

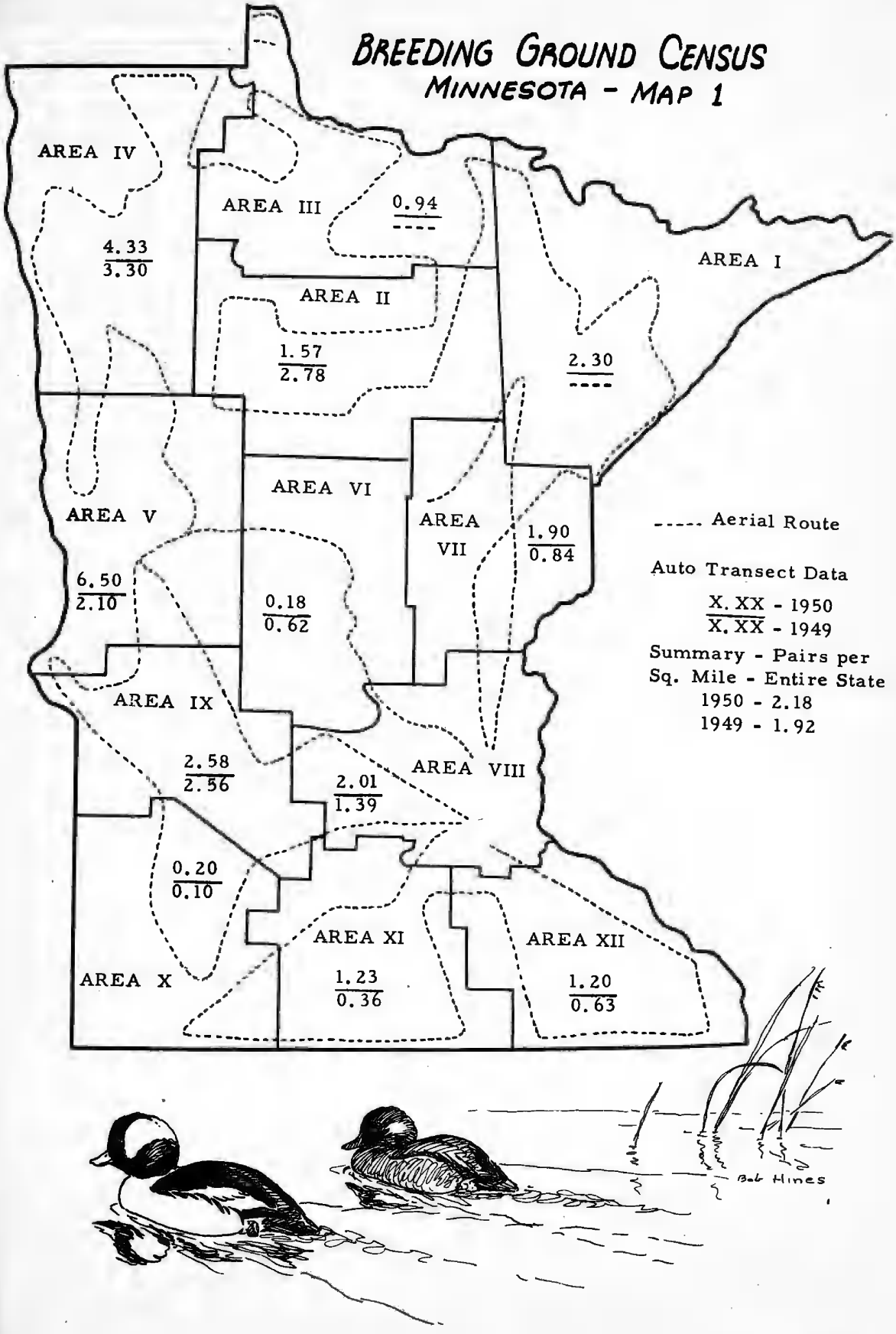
Flooding in the upper Red River Valley (Area 1V, northwest Minnesota) began about the first of April and continued through May. Ducks appeared in fair numbers during the first week of April, but it was not until the first week of May that a peak in numbers was noted.

The wooded northeast portion of the State (Areas 1, 11, 111, V1, V11) experienced an especially severe spring season. A snowfall of 10.5 inches was recorded for May at Virginia, in St. Louis County. Floods along the upper Mississippi River began during the latter half of April and continued through May. Floods also occurred in the Lake Superior drainage region. Large lakes such as Bemidji, Leech, and Mille Lacs were not completely open until May 20 (about a month later than the 1949 opening date of April 20 - 25 for these lakes). Most observers noted the first waterfowl after April 15, and largest numbers seem to have been present during the second week of May. Large flocks of ducks were noted during April and May in open water areas bordering these northern and northeastern portions of the State which experienced such adverse weather conditions. It appeared as if they were waiting for fairer weather before moving on north.

Breeding Population Trends

Automobile, canoe and aerial transects were run from the middle of May to the end of the first week in June by personnel of Pittman-Robertson Project 11-R. The ground sample by automobile was reduced from 1,663 square miles in 1949 to 898.6 square miles in 1950 (see Table 2), or a 1.06 percent sample of the State's area. Routes were run in 63 counties in 12 game management areas as compared with 39 counties in 7 game management areas last year. Area X11, representing 10 counties with very little duck habitat, was censused this year for the first time. Inclusion of this area tends to make the State's average somewhat conservative.

The average number of "pairs per square mile" for the entire State was 2.18 as compared with 1.92 for 1949. Thirty-eight counties were censused both in 1950 and 1949; 24 counties had higher "pairs per square mile" figures for 1950.


BREEDING GROUND CENSUS
MINNESOTA - MAP 1
AREA IV
4.33
3.30
AREA III
0.94
AREA I
AREA II
1.57
2.78
2.30
AREA V
AREA VI
AREA VII
1.90
0.84
6.50
2.10
0.18
0.62
AREA IX
2.58
2.56
AREA VIII
2.01
1.39
0.20
0.10
AREA XI
AREA XII
AREA X
1.23
0.36
1.20
0.63
----- Aerial Route
Auto Transect Data
X.XX - 1950
X.XX - 1949
Summary - Pairs per
Sq. Mile - Entire State
1950 - 2.18
1949 - 1.92
Bob Hines

Blank Page Digitally Inserted

Generally the game management areas having a higher "pairs per square mile" figure were those that contain the best duck breeding habitat of the State (See Map 1).

The very large "ducks per square mile" figure, especially for Areas 1V and V, is indicative of the large number of migrants present in the State late in the season when in ordinary years mostly resident breeding waterfowl are present.

Some changes over 1949 are noted in species composition. Mallard dropped from 22 percent to 18.04 percent in 1950. Pintail increased from 3.30 percent to 5.52 percent. Blue-winged teal dropped from 52.4 percent to 45.8 percent. Of the total water areas tallied, 30.20 percent were occupied as compared with 31.20 percent in 1949.

The aerial transect (See Map 1) was laid out according to the soil types of the State for the purpose of sampling proportionately the various topographic regions. A total of 3,029 miles, representing 757.25 square miles, or a 0.90 percent sample of the State's area, was flown. The flights were made from May 18 to June 2. A "ducks per square mile" figure of 3.88 was obtained for the entire State. In 1948 an aerial survey was made in the principal duck-producing portions of the State. Data of the 1948 flight and portions of the 1950 flight, pertaining to the same general area, when compared, show a somewhat higher population for 1950.

Success of the Season

Brood count data (Tables 3 and 4) were collected on 96 water bodies in 11 game management areas from July 1 to August 30. Counts were made along an estimated 319 miles of shoreline on an estimated 42,537 acres of water area. A total of 2,982 young ducks was counted. When the total acres of the survey (42,537) is divided by the total number of young ducks (2,982) a figure of 14.2 acres per young duck is obtained. Acres per young duck were calculated in previous years as follows: 1949, 13.8 acres; 1948, 17.3 acres; 1947, 66.1 acres; 1946, 124.2 acres.

Miscellaneous brood size data in addition to information from the specific counts were incorporated to give the "total counted broods" (Tables 3 and 4) used in calculation of final average brood sizes. All tabulated broods were classed as to "A" or "B" accuracy. Broods seen under conditions where it was apparent that the complete brood was seen were classed as "A." Broods seen in dense cover or conditions where only a partial count of young could be made were classed as "B." Only Class A broods were considered for calculation of average brood sizes.

A total of 459 broods was used in calculating the over-all average brood size of 7.3. The 1949 average brood size was 7.1.

Blue-winged teal, mallard, and ruddy duck young ranked highest in percentage composition of young waterfowl tallied this year. In 1949, blue-winged teal, mallard, and pintail ranked highest. A decrease in species composition of young is noted in blue-winged teal, mallard, and pintail from the 1949 figures.

The late spring undoubtedly retarded the start of the breeding season. Many of the "dabblers" were still paired on July 1. Nesting or renesting was such that broods were hatched out from early July to mid-August and a few broods of Class 1, downy young, were noted as late as September 1. Brood sizes were fairly large, giving the over-all average brood size of 7.3 as compared with 7.1 for 1949. This "scattering" of broods throughout the season made brood count data of specific areas of little use for comparison with last year's count on the same areas. The following summary of the number of broods by age class and date from Areas 1V, V, 1X, and X, illustrates the prolonged brood season.

July 1-15	Class			July 16-29	Class			July 30-August 12	Class		
	1	11	111		1	11	111		1	11	111
	85	25	7		43	59	28		65	46	82

Breeding conditions in game management Areas V, 1X, and X, were quite favorable. These areas contain numerous potholes, and water levels stayed up quite well during the summer. Most observers thought that the production of waterfowl in these areas was above 1949. The Area 1V manager found puddle ducks, especially mallards, less abundant than previously and divers somewhat more prominent. Brood counts in Areas 1, 11, and V11 were below last year. This is the part of the State that was affected by floods and a very late spring break-up date.

The aerial resident waterfowl count was flown by two biologists from August 29 to September 1. (See Map 2.) In 1949 it was flown during the second and third weeks of August. This is a repetition of the 1947 count in which a flight line of 2,222 miles was laid out in an attempt to sample all of the various types, both topographic and vegetative, found within the State. This flight line represents a 2/3 of 1 percent sample of the State's area. At the time of the 1947 count the State was divided into eight zones, following the pattern set by the More Game Birds Foundation in their count of 1935. Density figures were prepared to compare with the results of 1935. Thus the 1950 data are comparable to that of 1935, 1947, and 1949.

A total of 62,194 waterfowl was recorded as compared with 52,229 in 1949. The calculated waterfowl population per square mile was 112.0 as compared with 94.0 last year. Examination of Map 2 shows decreases from 1949 for zones 3, 4, and 6, the wooded northeastern part of the State, probably adversely affected by a late spring and flood conditions. Density figures that are near or above the 1949 averages are noted for other zones which contain the principal duck producing habitat of the State.

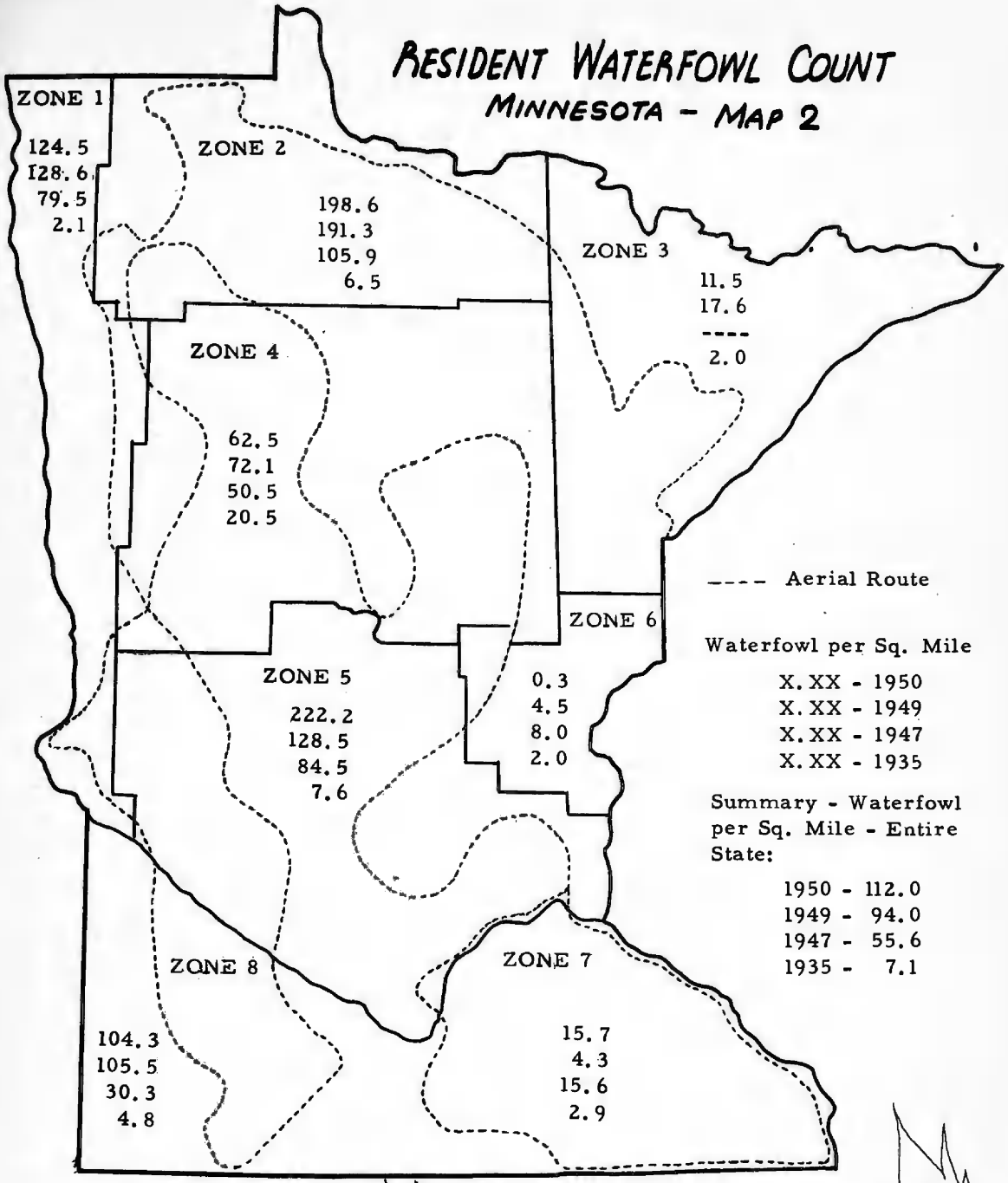
Summary

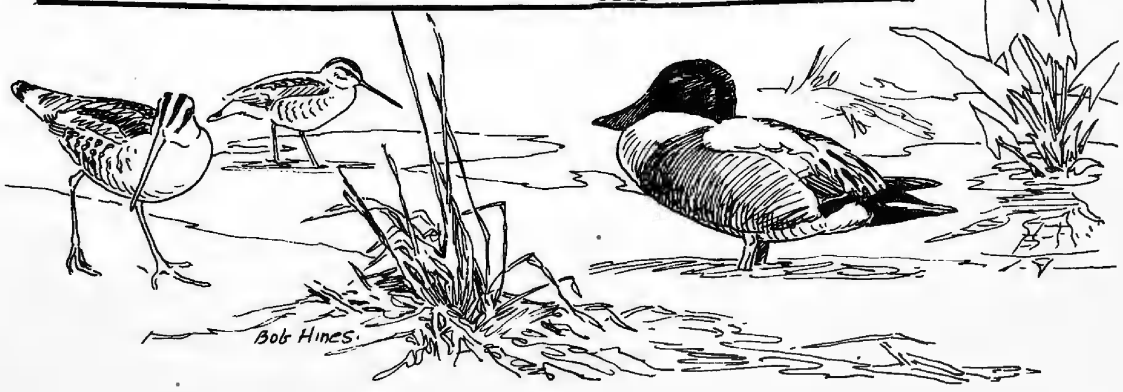
Spring breeding pair counts indicated an average breeding waterfowl population for the State comparable with or somewhat larger than that of 1949. An average brood size of 7.3 indicated that brood success was generally as good as or better than in 1949. Brood counts and summer breeding ground observations indicated that waterfowl production in the principal duck producing habitat of the State was probably somewhat better than last year, while in the poorer habitat of northeastern Minnesota, production was down, probably due to adverse flood and weather conditions in the spring. The aerial resident waterfowl count indicated a somewhat larger population for the State than in 1949.

Banding Summary -- August 1 to September 15

Species	Adult Male	Adult Female	Juvenile Male	Juvenile Female
B-w. teal	9	52	158	136
Pintail	1	-	10	14
Mallard	23	11	31	46
Gadwall	-	-	-	1
G-w. teal	1	-	1	3
Ringneck	-	-	2	1
Black duck	-	-	3	1
Redhead	-	-	8	5
Ruddy	1	-	-	-

RESIDENT WATERFOWL COUNT
MINNESOTA - MAP 2





Blank Page Digitally Inserted

Table 1. — Spring Migration Data, 1950. Total number of ducks observed tallied by week of observation. (Game management areas are arranged in a general north to south order.)

AREA	3/6-12	3/13-19	3/20-26	3/27-31	4/1-7	4/8-14	4/15-21	4/22-28	4/29 5/5	5/6-12	5/13-19	5/20-26
I					21	21	129	621	428	1,247	581	382
II							6	74	22			
III							70	761	78	417	1,534	493
IV				1	39	238	1,292	24,559	8,599	10,758	8,807	4,601
V			8	88	1,488	3,508	9,578	12,711	14,561	12,529	4,493	400
VI					860	743	4,703	15,454	15,513	11,880	14	
VII			16	14	123	45	844	1,144	6,443	3,550	3,268	570
VIII	15		20	2	933	2,297	2,363	3,390	8,249	2,127	117	75
IX	200			4,014	17,248	96,078	14,132	15,966	11,208	7,713	1,383	213
X	25		410	24,435	40,663	28,620	19,111	2,825	3,551	1,908	410	109
XI	200		1,121	17,077	61,753	37,245	3,855	12,238	3,128	7,478	3,036	623
XII		6	30	8,900	9,042	7,366	5,761	1,161	2,354	521	345	144
TOTALS	440	6	1,605	54,531	132,170	176,161	61,844	90,904	74,134	60,128	23,988	7,610

Table 2. — 1950 Waterfowl Breeding Ground Survey — Auto Transects

Area	1950 Number Counties Sampled	Square Miles Sampled	1950 Total Pairs	1950 Total Ducks	Pairs per Square Mile 1950	Pairs per Square Mile 1949	Ducks per Square Mile 1950	Ducks per Square Mile 1949	Water Areas Total Number	Water Areas Number Occupied	Water Areas Percent Occupied 1950	Water Areas Percent Occupied 1949
I	1	10.0	23	44	2.30	-	4.40	-	-	-	-	-
II	4	80.5	126	150	1.57	2.78	1.86	5.10	200	71	35.5	39.5
III	2	72.1	68	119	0.94	-	1.65	-	122	59	48.4	-
IV	8	101.5	439	2,085	4.33	3.30	20.54	3.90	1,210	261	34.1	25.2
V	4	50.0	325	1,836	6.50	2.10	36.72	4.67	570	350	61.4	43.9
VI	2	22.5	4	18	0.18	0.62	0.80	2.69	63	5	7.9	27.8
VII	2	30.5	58	115	1.90	0.84	3.77	4.86	44	27	61.4	40.0
VIII	3	37.8	76	131	2.01	1.39	3.47	2.55	236	45	19.1	16.7
IX	7	87.3	225	457	2.58	2.56	5.23	6.82	735	181	24.63	38.23
X	10	129.8	128	228	0.20	0.10	1.76	0.61	506	86	17.0	23.6
XI	10	151.4	408	923	1.23	0.36	6.10	2.96	331	156	47.1	28.9
XII	10	125.0	79	139	0.63	1.20	1.11	2.63	175	25	14.3	24.1
STATE		898.6	1,959	6,245	2.18	1.92	6.95	3.84	4,192	1,266	30.2	31.2

Table 3. — Minnesota Brood Count (All Species) Data, by Game Management Areas.
Additional brood size data are incorporated to give final average brood sizes.

	Area I	Area II	Area III	Area IV	Area V	Area VII	Area VIII	Area IX	Area X	Area XI	Area XII	All Areas
No. of water areas	5	7	3	4	9	5	2	38	14	7	2	96
No. of acres	148	4,940	4,360	3,060	1,500	10,100	140	8,559	1,137	7,753	840	42,537
Miles of shoreline	7.5	28	15.0	16.7	15	108	10	67	18	30	4	319.2
Maternal)-without broods	-	5	-	8	2	4	-	4	14	12	2	51
females)-with broods	1	19	-	82	48	61	24	25	63	115	15	453
Uncounted broods	-	-	-	41	6	19	1	6	16	50	5	144
Counted broods	1	19	-	41	42	42	23	21	47	65	10	311
Counted young	3	150	-	247	334	206	149	152	353	533	76	2,203
Average brood) I	-	-	-	6.1	8.1	4.3	5.5	7.2	7.4	8.4	8.7	7.5
size by II	-	7.9	-	7.7	7.3	4.9	7.0	7.6	6.9	7.8	5.5	7.0
Age Class) III	-	-	-	4.9	9.0	5.1	7.4	-	8.5	8.5	6.5	6.3
Total no. of young	3	150	-	476	363	272	151	182	458	819	108	2,982
Adults other than maternal females	-	92	64	615	487	320	23	1,218	392	717	25	3,953
Grand total of waterfowl	4	266	64	1,181	900	657	198	1,429	927	1,663	150	7,439
No. per acre	.03	.05	.02	.39	.60	.07	1.40	.17	.82	.22	.18	.18
No. per mi. of shoreline	.50	9.5	4.30	70.70	60.00	6.08	19.80	21.33	51.50	55.43	37.5	23.31
Total counted)-No. broods	8	21	4	64	90	42	33	48	66	73	10	459
broods)-No. young	44	165	28	414	693	206	236	389	501	591	76	3,343
Average) - 1949	4.0	6.4	-	6.9	7.1	7.2	6.8	6.7	7.9	7.1	-	7.1
brood size) - 1950	5.5	7.9	7.0	6.5	7.7	4.9	7.2	8.1	7.6	8.1	7.6	7.3

Table 4. — 1950 Brood Count Data by Species. Miscellaneous brood size data incorporated for average brood size.

	Maternal Females		Uncounted Broods	Counted Broods		Total No. Young	Comparative Abundance Between Young in percent			Adults other than Maternal females	Total of Species	Comparative Abundance Between Species in percent			Total Counted Broods Incl. Misc.obs.		Average Brood Size		
	Without Broods	With Broods		No. broods	No. young		1948	1949	1950			1948	1949	1950	Broods	Young	1948	1949	1950
Mallard	30	64	11	54	349	396	37.7	20.3	13.3	662	1152	29.7	15.5	15.5	80	546	7.1	6.6	6.8
Black duck	—	—	—	—	—	—	1.5	.2	—	27	27	.8	.9	0.4	5	31	5.6	5.0	6.2
Pintail	2	22	6	16	105	132	1.9	11.7	4.4	165	321	3.7	6.4	4.3	23	151	7.9	8.1	6.6
Gadwall	2	13	2	11	60	65	1.4	.6	2.2	27	107	1.1	.7	1.4	12	66	—	6.3	5.5
Baldpate	2	4	2	2	4	10	2.6	2.2	.3	26	42	1.5	2.3	.6	2	4	8.8	6.7	2.0
Shoveler	—	8	1	7	49	56	.5	.2	1.9	58	122	.5	.1	1.6	9	63	—	6.0	7.0
G-w. teal	—	1	—	1	6	6	—	.3	.2	—	7	—	.3	.1	1	6	—	4.5	6.0
B-w. teal	11	175	46	130	991	1281	42.2	49.5	43.0	906	2373	35.4	32.5	31.9	196	1542	10.0	7.4	7.9
Wood duck	1	15	9	6	57	100	1.7	3.1	3.4	92	208	1.4	3.2	2.8	8	75	—	6.6	9.4
Canvasback	—	14	4	10	61	85	—	3.9	2.9	56	155	.2	2.2	2.1	11	70	—	7.3	6.4
Redhead	—	19	—	19	161	161	3.3	2.0	5.4	207	387	11.8	2.2	5.2	38	299	8.4	6.5	7.9
Ringneck	1	13	1	12	58	64	1.5	1.7	2.2	127	205	1.3	2.5	2.8	14	81	10.3	5.6	5.8
L. scaup	—	10	6	4	26	49	1.0	—	1.6	42	101	1.2	.3	1.4	9	54	—	—	6.0
Golden-eye	2	14	—	14	112	112	—	1.4	3.8	13	141	.2	.7	1.9	14	112	—	7.7	8.0
Ruddy	—	30	7	23	146	177	2.6	2.4	5.9	348	555	3.5	5.3	7.5	34	215	5.1	6.2	6.3
W-w. scoter	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—
Merganser	—	—	—	—	—	—	—	.1	—	—	—	.1	.1	—	1	10	—	2.0	10.0
Unidentified	—	29	27	2	18	203	1.1	2.1	6.8	510	742	3.4	8.7	10.0	2	18	—	7.3	9.0
Coots	—	22	22	—	—	85	—	.3	2.9	686	793	4.2	16.3	10.7	—	—	—	—	—
ALL SPECIES	51	453	144	311	2203	2982				3953	7439				459	3343		7.1	7.3

WATERFOWL BREEDING GROUND SURVEYS CHIPPEWA NATIONAL FOREST, MINNESOTA 1937 to 1950

Jerome H. Stoudt

The annual Chippewa National Forest waterfowl census was run for the ninth time since 1937 with the assistance of U. S. Game Management Agent, Dwight Morse, of Bemidji, Minnesota.

Methods and Area Covered

The census was run one week later this year (July 16-22) due to the late spring break-up. Although the time of census was just about right, the highest water levels in 50 years prevailed on all areas affected by the War Department dam at Lake Winnibigoshish. As half of the census areas are directly affected by this dam, difficulty was again encountered and an accurate census was impossible for most species. On Bowstring Lake, which lies in the Hudson Bay drainage, water levels were about normal and here the duck population was very close to the 1939 and 1940 average, which is considered normal for this area.

Data Collected

The following table illustrates the results of the 1950 census as compared to previous years and to the 1939-40 period which has been considered "par" for the Chippewa area.

Table 1. -- Waterfowl Censuses, Chippewa Forest, 1939-50

Area	1939-40	1947	1948	1949	1950	Change From 1939-40
Bowstring Lake	519	498	461	337	521	+ 2
Burns Lake	215	107	170	84	108	— 107
Kitchi Lake	241	168	239	48	69	— 172
Lower Pigeon Lake	28	5	24	30	57	+ 29
Mud Lake	181	230	271	200	81	— 100
Rabideau Lake	94	119	215	49	64	— 30
Raven Lake	198	33	22	17	25	— 173
Round Lake	580	490	606	574	382	— 198
Third River	650	420	1010	526	301	— 349
L. Winnibigoshish	568	262	88	224	157	— 411
Totals	3274	2332	3106	2089	1765	—1509 — 46%

It is believed that high water levels on the Chippewa do not affect the production of the mallard, baldpate, and golden-eye which make up about 90 percent of the breeding population. However, the accuracy of the census is affected due to the fact that many mallard broods stay in the flooded meadows, swamps, and brush-covered lowlands; and do not come down to the lakes and streams until water levels recede. Analyzing the data a bit further we find that on certain census areas where water levels were nearly normal the duck population was closer to the "par" of 1939 and 1940. Table 2 illustrates this fact.

Table 2. -- Effects of High Water Levels on Censuses

(Lakes Affected Directly or Indirectly by Winnibigoshish and Leech Lake Dams.)

Area	1939 & 1940	1950	Difference
Kitchi Lake	241	69	— 172
Mud Lake	181	81	— 100
Raven Lake	198	25	— 173
Third River	650	301	— 349
Lake Winnibigoshish	568	157	— 411
Total	1838	633	—1205
			— 66%
Gauge Readings at Winnibigoshish	9.64	13.80	

(Lakes not affected or affected only slightly.)

Area	1939 & 1940	1950	Difference
Bowstring Lake	519	521	+ 2
Burns Lake	215	108	— 107
Rabideau Lake	94	64	— 30
Round Lake	580	382	— 198
Lower Pigeon Lake	28	57	+ 29
Total	1436	1132	— 304
			— 21%

From a trend standpoint it is believed that the actual waterfowl population on the Chippewa National Forest is actually about that represented by the census data from areas unaffected by the dam levels. Thus the total duck population may be only about 20 percent under the "par" of 1939-40 rather than 46 percent less as indicated by the data from all census areas (Table 1).

Total population estimates for the Chippewa area are as follows:-

1937 - 29,600	1947 - 28,500
1938 - 46,650	1948 - 37,700
1939 - 40,300	1949 - 25,400 *
1940 - 46,400	1950 - 22,630 *
1941 - 26,150 *	1950 - 34,200 **

* Census inaccurate and population considered too low due to high water levels at dams.

** Population calculated from census areas unaffected by high water.

Species Composition

The six main species of breeding ducks on the Chippewa have been the mallard, baldpate, blue-winged teal, ring-necked duck, and golden-eye, Table 3 illustrates the variation in species composition encountered, since the inception of the census.

Table 3. -- Annual Species Composition

Year	Mallard	Baldpate	Golden-eye	B-w. teal	Ring-neck	All others
1937	32	5	20	22	13	8
1938	49	3	10	23	9	6
1939	45	4	15	28	5	3
1940	44	7	15	21	10	3
1941	47	12	11	14	4	6
1947	49	15	19	7	5	6
1948	52	17	13	10	8	3
1949	44	24	19	6	4	3
1950	43	30	17	4	4	2

Several facts present themselves: -

(1). Relative stability of the mallard and golden-eye.
(2). Steady increase of the baldpate since 1940.
(3). Tremendous decrease in blue-winged teal.

The decrease in teal may be attributed to improved habitat in the prairie nesting grounds since 1939. During the drought of the 30's there is no doubt but that a shift of prairie nesting waterfowl occurred into the lake region of Minnesota. But what caused the existing population of teal on the Chippewa to dwindle to almost zero is a bit harder to explain. Perhaps the flooding of meadows which were dry in 1936 and 1937 is the answer, but these areas were flooded in 1938 and 1939 with no resultant drop in the teal population.

Brood Averages

Table 4 illustrates brood averages based upon brood counts on census areas since 1937. Only the mallard is included, because there is paucity of data for certain years and certain age classes in other species of ducks.

Table 4. -- Mallard Brood Averages By Age Classes - 1937-50

	AGE CLASSES				
Year	I	II	III	All	No. of Broods
1937	-	6.3	6.5	6.5	(56)
1938	8.8	7.8	6.5	7.3	(166)
1939	8.8	7.6	7.4	7.8	(256)
1940	8.7	7.4	7.0	7.8	(94)
1941	-	7.3	6.7	6.9	(17)
1947	7.8 *	7.9	7.0	7.5	(67)
1948	7.1 *	7.6	6.8	7.2	(102)
1949	4.8 *	6.8	6.7	6.4	(31)
1950	8.1 *	7.2	6.6	7.0	(49)
Average	8.4	7.5	6.9	7.4	(838)

* Only seven broods counted in age Class I each of these years.

Adult Juvenile Ratios

Table 5 illustrates adult-juvenile ratios for all ducks seen on the census.

Table 5. -- Adult - Juvenile Ratios - 1950

Species	Adults	Juveniles	Ratio
Mallard	177	585	1 to 3.3
Baldpate	118	405	1 to 3.4
Golden-eye	114	189	1 to 1.7
Blue-winged teal	19	47	1 to 2.5
Ring-neck	28	47	1 to 1.7
All others	14	22	1 to 1.6
Total	463	1295	1 to 2.7

The ratio of adults to juveniles for all species for each year of the census is as follows:

1937	1938	1939	1940	1941	1947	1948	1949	1950
1:3.0	1:2.2	1:3.4	1:1.5	1:2.7	1:2.2	1:4.0	----	1:2.7

A fact to take into consideration in the above data is that very few molting drakes are observed on the census so that most all of the adults include; maternal hens, pairs, and lone drakes or hens which can still fly.

From Table 5 we could conclude that breeding success as measured by the ratio of juveniles to adults was at least average.

Summary

In conclusion the following points seem pertinent:

1. Extremely high water levels on certain census areas caused some broods to be missed, so total estimate must be revised accordingly.

2. Raw data shows a 15 percent decrease from 1949 and 46 percent decrease from the average for 1939-40. Revised estimates based on areas unaffected by high water would place the waterfowl population at about the same as for 1949 and only about 20 percent under the 1939-40 figures.

3. Mallard and golden-eye continue at about the same relative abundance with baldpate showing a steady increase since 1940. Blue-winged teal were almost out of the picture.

4. Brood averages were slightly below the nine year average.

5. The ratio of juveniles to adults indicated at least average breeding success, but it is considerably lower than the 1948 figures.

WATERFOWL BREEDING GROUND SURVEY IN IOWA - 1950

James G. Sieh

Background and Progress

Iowa is in the initial stage of statewide waterfowl production study and habitat improvement. Most of the few remaining waterfowl producing areas in northwest Iowa are now State owned and managed. Resident area managers (similar to U. S. Fish and Wildlife Service Refuge Managers) have been assigned to three established management units. It is hoped that permanent ground transects can be established on each management unit to provide annual waterfowl trend data. An airplane has recently been added to the State Conservation Commission inventory and it is hoped that aerial transects can be established on a statewide basis during 1951.

Iowa has pioneered in the field of academic research on waterfowl. There are six doctoral theses and five masters' theses dealing with waterfowl production on file in the Iowa State College Library. Data were gathered for a sixth master's thesis during the summer of 1950 in a study of wood duck production on Lake Odessa near the Mississippi River in southeastern Iowa. This basic waterfowl research has been directed by the Wildlife Unit, Iowa State College; in cooperation with the Iowa State Conservation Commission, U. S. Fish and Wildlife Service, and the Wildlife Management Institute.

In 1949 the Iowa State Conservation Commission assigned a biologist to evaluate the waterfowl resource in Iowa and to gather data dealing with production, management, and harvest of this game crop. Meager population trend data were gathered for the first time during the breeding season of 1949 and again in 1950. Production data have been limited to on-the-spot check counts made on productive areas in northwestern Iowa. The three major waterfowl-producing areas in northwestern Iowa have been named and encircled on the pictorial map to emphasize their geographical location. The other lakes and sloughs also represented by dots on this map have been spot checked one or more times during the summer to determine their value to waterfowl. No serious attempt has yet been made to determine the extent of wood duck production along the major rivers in Iowa. It is the opinion of the writer at this time that wood duck production in Iowa is increasing, and at present may equal or exceed the production of any other species in the State.

Spring Migration - 1950

Weather conditions during the spring of 1950 caused delay in the arrival and departure of waterfowl in Iowa. Early migrants (Mallards, pintails, and American mergansers) reached the Ruthven area following the first spring thaw of March 4 - 7. Several thousand ducks and a few flocks of geese were reported in northwestern Iowa prior to March 7, 1950. This date, however, marked the first major advance of migratory waterfowl across Iowa. There were earlier reports of some migrants working northward along the major rivers of the State, but these few were harbingers of migrants yet to come.

On the afternoon of March 7, 1950, low cumulus clouds gathered rapidly in northwest Iowa causing rain followed by snow. By night blizzard conditions prevailed with 70-mile-per-hour winds. These weather conditions and continued freezing temperatures during the two-week period of March 7 - 21 caused a retreat of migratory waterfowl from northwest Iowa and from the remainder of the State according to all available reports. On March 22 thawing weather returned to northwestern Iowa, and

by March 23 waterfowl were again present. The migratory flight appeared to move rapidly into Iowa, and the concentration of both ducks and geese caused by a late spring and ice conditions farther north may have given a false impression as to the actual size of the migratory flight in Iowa. In the northwestern part of the State, concentrations of ducks and geese were more impressive than last spring, but there was no evidence to support an actual increase in total migratory numbers over last year. Certainly the concentrations were larger and more impressive, with more birds present in local areas for a short period of time.

This year the duration of the migratory flight was shorter than last year. The main flight began about March 25 and began to diminish appreciably by April 20 in northwestern Iowa. Mallards and pintails were the most abundant species; and diving ducks, with the exception of lesser scaup and ruddy ducks, were present only for a very few days during the second and third week in April. The green-winged teal flight overlapped somewhat beyond the limits of the aforementioned species, while the blue-winged teal and ruddy duck flight continued beyond May 15.

The blue-winged teal flight was estimated to be larger (total number of migrants) than last spring with approximately the same number of resident (breeding) birds remaining in Iowa. More Richardson's or Hutchin's geese (B. canadensis hutchinsi) were observed in northwestern Iowa this year. Wilson's snipe (Capella gallinago) and Wilson's phalarope (Steganopus tricolor) also appeared more numerous this spring than during the spring of 1949. Coot populations were again low and approximately the same number of migrants were observed as in 1949.

Waterfowl Production

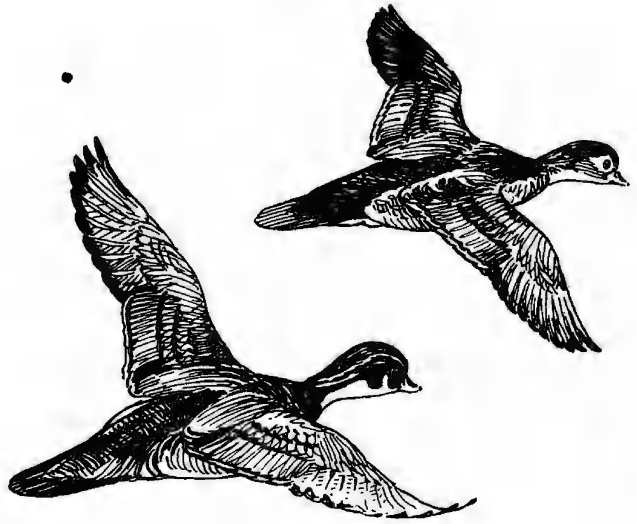
The late spring of 1950 caused the blue-winged teal in Iowa to nest within a more restricted period this year than in 1949. More teal began to nest about the same calendar date and broods appeared closer to the same calendar date. The effect this had on survival or renesting was not determinable. There was no apparent change in blue-winged teal production between 1949 and 1950. Nesting coot appeared fewer in number and in density per area checked during 1950 than during 1949. From all indications mallard and redhead production was slightly better than last year. Data indicate fewer ruddy ducks nesting in the check areas this year, but the data are not conclusive. Authentic reports of wood duck broods were received the second week in June from the eastern part of the State to compare with excellent production and survival witnessed on several areas. No broods or nests of lesser scaup were seen in Iowa during 1949 or 1950, but some adults were observed throughout both nesting seasons. Comparatively large groups (5-25) of both paired and unpaired lesser scaup remained in Iowa until the second week in June and then disappeared. There was no evidence that they attempted to nest before disappearing. A few scattered groups of male shovelers remained in Iowa until the second week in June and also disappeared. All other waterfowl observed were considered as breeding adults.

Waterfowl counts on the same marshes have been made in 1949 and again in 1950. These waterfowl counts (see Table 1) represent breeding adults and are only partial indicators of comparative waterfowl abundance (trend) in Iowa. This was indicated by the complete absence of coot from one former nesting area (Hottes Lake) where nesting habitat was eliminated by water level change during 1950. The reduction in ruddy duck numbers on Round Lake may have been caused by the incompatibility of ruddies and black-crowned night herons occupying the same area for nesting purposes. All other counts are apparently unbiased.

IOWA

WATERFOWL BREEDING GROUND SURVEY

1950



LAKES & SLOUGHS

RUTHVEN AREA

ESTHERVILLE AREA

SPIRIT LAKE—OKOBOJI AREA

Blank Page Digitally Inserted

Water and Weather Conditions

Water levels were much reduced during the late fall of 1949 in the marshes and sloughs of northwest Iowa. Little rainfall during the early spring of 1950 may have caused a slight reduction in the over-all nesting habitat available. Ample rainfall during late spring and early summer maintained almost all waterfowl producing areas throughout Iowa in better than average condition for the remainder of the production period. Up until September 15, 1950, below-normal summer temperatures prevailed.

Banding Operations

Iowa is now cooperating with the Fish and Wildlife Service under the master permitee system and bird-banding supplies are on hand. No waterfowl banding was carried on during 1950, but provisions are being made to carry on a limited banding program as soon as it is practicable.

Summary

A late spring in 1950 caused large concentrations of migratory waterfowl in Iowa, but there is no conclusive proof indicating that larger total numbers of waterfowl passed through Iowa in 1950 than in 1949.

The 1950 migratory flight was of shorter duration than it was in 1949. The migratory flight of blue-winged teal, Hutchin's goose, Wilson's snipe, and Wilson's phalarope was estimated to be larger in total numbers in 1950 than in 1949.

Migrant coot populations were estimated to be low, and approximately the same number of migrants were observed in 1950 as in 1949.

Nesting coots appeared fewer in number and reduced in density per area checked during 1950 as compared with 1949.

Data would indicate fewer ruddy ducks nesting in the check areas this year, but the data alone are not conclusive.

It is the opinion of the writer that the breeding populations of mallards and redheads in Iowa were slightly more numerous in 1950 than in 1949.

The blue-winged teal population trend was about the same as last year with no indication of any decrease in Iowa production.

It is the opinion of the writer that Iowa produces a substantial number of wood ducks and that their production is increasing; and that wood duck production may equal or exceed the production of any other species of waterfowl in the State at the present time.

Table 1. -- Iowa Waterfowl Counts - Population (1949-1950) Trend Data

	AREA CENSUSED							
	Trumbull Lake (Ruthven Area) Clay County				Round Lake (Ruthven Area) Clay County			
Acres	1229				450			
	1949		1950		1949		1950	
	M	F	M	F	M	F	M	F
Mallard			1	-	2	1	3	1
Black duck			-	-	-	-	-	-
Gadwall			-	-	-	-	-	-
Baldpate	N		-	-	-	-	-	-
Pintail	O		-	-	1	1	1	-
G-w. teal	T		-	-	-	-	-	-
B-w. teal			-	-	8	2	4	-
Shoveler	C		-	-	-	-	-	-
Wood duck	H		3	3	-	-	6*	
Redhead	E		-	-	-	-	-	-
Ringneck	C		-	-	-	-	-	-
Canvasback	K		-	-	-	-	-	-
Lesser scaup	E		-	-	-	-	-	-
Golden-eye	D		-	-	-	-	-	-
Bufflehead			-	-	-	-	-	-
Ruddy duck			-	-	14	2	2	-
Merganser			-	-	-	-	-	-
Total ducks			4	3	25	6	17	
Coot	25		0		74		100	
Florida gallinule	-		-		1		-	
Pied-billed grebe	-		-		6		2	
B-c night heron	-		-		-		100	
Upland Plover	-		-		-		-	
Snow goose	-		-		-		-	

* Sex unidentified

Table 1. -- Iowa Waterfowl Counts - Population (1949-1950) Trend Data (continued)

AREA CENSUSED

	Dewey's Pasture (Ruthven Area) Clay County						West Hottes Lake (Spt.-Okoboji Lake Area) Dickinson County			
Acres	406 (50% censused)						312			
	1948		1949		1950		1949		1950	
Species	M	F	M	F	M	F	M	F	M	F
Mallard	2	2	2	2	3	3	-	-	1	-
Black duck	-	-	-	-	-	-	-	-	-	-
Gadwall	1	1	-	-	-	-	-	-	-	-
Baldpate	-	-	-	-	-	-	-	-	-	-
Pintail	-	-	-	-	-	-	-	-	-	-
G-w. teal	-	-	-	-	-	-	-	-	-	-
B-w. teal	8	8	6	6	8	7	8	6	6	1
Shoveler	-	-	-	-	1	-	-	-	-	-
Wood duck	-	-	-	-	-	-	-	-	-	-
Redhead	2	2	3	3	3	3	-	-	-	-
Ringneck	-	-	-	-	-	-	-	-	-	-
Canvasback	-	-	-	-	-	-	-	-	-	-
Lesser scaup	-	-	-	-	2	2	-	-	-	-
Golden-eye	-	-	-	-	-	-	-	-	-	-
Bufflehead	-	-	-	-	-	-	-	-	-	-
Ruddy duck	2	2	3	3	5	1	-	-	-	-
Merganser	-	-	-	-	-	-	-	-	-	-
Total Ducks	15	15	14	14	22	16	8	6	7	1
Coot	20		20		25		30		None	
Florida gallinule	-	-	-	-	-	-	-	-	-	-
Pied-billed grebe	-	-	-	-	-	-	-	-	-	-
B-c night heron	-	-	-	-	-	-	-	-	-	-
Upland Plover	-	-	-	-	-	-	-	-	-	4
Snow goose	-	-	-	-	-	-	-	-	-	-

Table 1. -- Iowa Waterfowl Counts - Population (1949-1950) Trend Data (continued)

	AREA CENSUSED							
	Jemmerson Slough (Spt. -Okoboji Lake Area) Dickinson County				North Slough - Mud Lake (Estherville Area) Emmett County			
Acres	160				25			
	1949		1950		1949		1950	
Species	M	F	M	F	M	F	M	F
Mallard	-	-	1	1	5	5	8	5
Black duck	-	-	-	-	-	-	-	-
Gadwall	-	-	-	-	-	-	-	-
Baldpate	-	-	-	-	-	-	-	-
Pintail	-	-	-	-	-	-	-	-
G-w. teal	-	-	-	-	-	-	-	-
B-w. teal	3	2	5	5	8	3	9	6
Shoveler	-	-	-	-	-	-	-	-
Wood duck	-	-	-	-	-	-	-	-
Redhead	-	-	-	-	3	1	4	2
Ringneck	-	-	-	-	-	-	-	-
Canvasback	-	-	-	-	-	-	-	-
Lesser scaup	-	-	-	-	4	2	-	-
Golden-eye	-	-	-	-	-	-	-	-
Bufflehead	-	-	-	-	-	-	-	-
Ruddy duck	-	-	-	-	2	1	-	-
Merganser	-	-	-	-	-	-	-	-
Total ducks	3	2	6	6	22	12	21	13
Coot	12	-	10	-	21	-	-	-
Florida gallinule	-	-	-	-	-	-	-	-
Pied-billed grebe	-	-	2	-	1	-	-	-
B-c night heron	-	-	-	-	-	-	-	-
Upland Plover	-	-	-	-	-	-	-	-
Snow goose	-	-	-	-	-	-	-	-

Table 1. -- Iowa Waterfowl Counts - Population (1949-1950) Trend Data (continued)

	AREA CENSUSED					
	Cheever Lake (Estherville Area) Emmett County		Four Mile Lake (Estherville Area) Emmett County			
Acres	341		219			
	1950		1949		1950	
Species	M	F	M	F	M	F
Mallard	7	-	6	2	6	3
Black duck	-	-	-	-	-	-
Gadwall	-	-	-	-	-	-
Baldpate	-	-	-	-	-	-
Pintail	-	-	1	-	1	-
G-w. teal	1	1	-	-	-	-
B-w. teal	11	2	12	4	9	2
Shoveler	-	-	-	-	1	1
Wood duck	-	-	-	1	1	-
Redhead	-	-	-	-	4	5
Ringneck	-	-	-	-	-	-
Canvasback	-	-	-	-	-	-
Lesser scaup	2	3	6	2	-	-
Golden-eye	-	-	-	-	-	-
Bufflehead	-	-	-	-	-	-
Ruddy duck	-	-	-	-	-	-
Merganser	-	-	-	-	-	-
Total ducks	21	6	25	9	22	11
Coot	80	-	72	-	80	-
Florida gallinule	-	-	-	-	-	-
Pied-billed grebe	-	-	-	-	8	-
B-c night heron	-	-	-	-	-	-
Upland Plover	-	-	-	-	-	-
Snow goose	-	-	-	-	-	-

WATERFOWL BREEDING GROUND SURVEY IN WISCONSIN - 1950

R. C. Hopkins, F. A. Hartmeister, R. W. Mihalek,
L. R. Jahn, and W. M. Kitz

Waterfowl Breeding Population, Spring - 1950

Introduction

During the period from May 8 to June 2, 1950, personnel of the Wisconsin waterfowl research project again conducted the annual waterfowl breeding ground survey. The same five methods of census were employed over nearly identical routes covered in 1949. With the exception of ground cruises conducted on Horicon Marsh, which are not covered in this report, the other four methods employed were as per standard operating procedure outlined by the Fish and Wildlife Service with all methods employing 1/4-mile census strips.

Methods

To simplify and standardize computation of the total number of breeding pairs, the following procedure was used. In all instances and for all species, the estimated number of breeding pairs was computed on the basis of the total pairs seen plus total lone drakes, plus total lone females. (The last comprise less than 1 percent of the total). No attempt was made to differentiate between species which are known to breed locally and late breeding transient species such as scaups and ruddys. An examination of the tables on species composition (not included in this report) indicates quite clearly that these late breeding transient species were largely flocked. Consequently, their representation as breeding pairs in a few instances should not alter final results appreciably. However, there is no question but that this method will tend to favor the data for 1950 slightly.

The following cited digressions constitute the only known human factors which differ from last year's coverage of census routes.

1. Coverage of transects was begun one week later in 1950 than in 1949 to allow for an apparent phenological lag induced by a later spring in 1950. It is the opinion of the waterfowl research project that, phenologically speaking, our census work was begun at approximately the same time during the breeding season or slightly earlier than during 1949. (First reported mallard hatching dates -- May 21 and May 24 -- tend to substantiate this).

2. Small portions of two automobile transects involving only a few miles were altered to enhance travel. These changes were of such insignificance as to be hardly noteworthy.

3. Project personnel were present on all transect coverages made; the employment of cooperators was largely discontinued in the interests of standardizing observations and because our staff had been increased. However, it is highly questionable if any difference whatsoever would be encountered here in view of the fact that cooperators employed previously were all top caliber observers.

4. One aerial transect of about 40 miles in south-central Wisconsin was discontinued because of a fur farm on the transect course. Here again it is questionable if any discrepancy should arise in view of the fact that roughly 250 lineal miles were censused elsewhere in this soil region.

5. In the interests of standardizing our methods of coverage by automobile transects, all observers were instructed to cruise on foot the edge of all water areas lying within the transect to eliminate, in so far as possible, any possibility of omission of birds through "superficial" coverage. (Note: Previously cruising was occasionally limited to approach of an area and examination with binoculars when cover conditions were sparse; for our purposes such coverage is herewith termed "superficial" in contrast to a complete cruise of the periphery of the water area being censused). Thus, in view of slightly more intensive coverage during 1950, it is probable that the 1950 ground transect data would be favorable as compared with the 1949 data.

6. A small amount of additional data from new transects covered in 1950 was eliminated from this report to obviate any possible statistical error through such inclusion.

Weather Conditions

Climatological data for Wisconsin for the month of May as prepared by the U. S. Weather Bureau are not available for this report, but there appears to be little doubt that there was a definite increase in rainfall in Wisconsin for the spring of 1950 as compared to 1949. Secondly, the month of April was reported to be the second coldest in some 50 years. Cold weather persisted throughout most of May. Weather conditions appeared comparable to those of the spring of 1947 in southeastern Wisconsin if not more severe, and in the northern half of the State the spring breakup was perhaps the latest on record.

There is no doubt that the severe spring weather delayed spring migratory movements of waterfowl in Wisconsin, particularly in the northern half of the State; and there were opinions expressed by many observers to the effect that breeding birds apparently stayed in Wisconsin whereas in a normal year they would have moved on north into Canada. This assumption, although seemingly logical, would be exceedingly difficult to prove. A subsequent chronological analysis of territorial observations showed much later breeding dates for mallards and blue-winged teal than is normal; and the conclusion that weather is responsible for retarding the breeding season two or more weeks seems inescapable.

An analogous retardation of territorial behaviour and egg production was observed generally for captive Canada goose breeding flocks in southeastern Wisconsin and at Horicon, and for the breeding flock of captive mallards at Horicon. Since such flocks are provided with all essentials to be needed in the way of food, grit, and habitat, it again seems very evident that weather must be the causative factor in retarding the breeding phenology during 1950.

Water Conditions

An analysis of ground transect data indicates a 51 percent increase in the number of water areas for the State; the total estimated acreage of water area censused involved increased to roughly 6,000 acres from about 3,700 acres in 1949. There was an average of some 2.55 areas per square mile in May of 1950 as compared with an average of 1.65 areas per square mile last year, and 2.28 areas per square mile in 1948.

Flood conditions on the Mississippi River evidently persisted until well into May and might have had a serious effect on local breeding conditions for waterfowl.

Table 1. -- Water Areas and Utilization By Waterfowl *

Soil	Total Areas 1950	Total Areas 1949	% Increase or Decrease	% Occup. 1950	% Occup. 1949	Total Est. Acres 1950	Total Est. Acres 1949
Central Sand	54	37	46	11	14	2613	687
Northwest Sand	141	118	19	16	10	758	600
River Bottoms	35	31	13	0	13	757	717
Miami Fine Sandy Loam	65	41	59	10	17	141	51
Southeast Miami Loam	241	161	50	17	37	969	825
Southeast Prairie	86	46	87	16	17	202	149
Southwest Driftless	5	11	—55	0	0	14	40
Northern Kennan	184	123	50	8	6	596	518
Eastern Red Clay	71	18	294	14	17	90	152
Totals	882	586	51%	10	18	6140	3739

Note: Water areas per square mile: 1948 - 2.28
1949 - 1.65
1950 - 2.55

* Based on ground transect data only.

Table 2. -- Summary of Waterfowl Population Densities - Wisconsin, 1950

(Based on a total of 4,927 ducks, coots, and geese censused).

Census Method	Est. Pairs per Sq. Mi. 1950	1949	Percent Change	Ducks per Sq. Mi. 1950	1949	Percent Change	Coots per Sq. Mi. 1950	1949	Percent Change
Cross country transects (ground) 356 sq. mi. sample	0.61	0.65	- 3	1.7	1.5	20	0.2	0.4	-54
Cross country transects (aerial) 429 sq. mi. sample	0.35	0.43	-19	1.7	2.2	- 23	0.39	0.24	65
Lake and Marsh surveys (aerial) 75 sq. mi. sample	3.2	3.1	3	29.1	20.8	39	8.0	7.2	- 2
River Surveys (aerial) 76 sq. mi. sample	0.42	0.96	-56	5.5	5.2	6	0.88	4.1	- 79

Summary of Data on Waterfowl Species Composition in Percentage for Principal Species - Wisconsin, 1950

Species	Ground (C.C.) 1950	1949	Aerial (C.C.) 1950	1949	Lake & Marsh (aerial) 1950	1949	Rivers (aerial) 1950	1949
Mallard *	12	27	26	26	15	23	7	33
Blue-winged teal *	36	44	14	4	6	3	1	3
Scaup *	25	7	37	45	49	48	85	45
Coot **	10	22	18	10	21	27	14	44

Note: * Expressed in terms of total identified ducks
** Expressed in terms of total identified ducks, coots, and geese

Discussion and Conclusions

Tables 1 and 2 portray a summary of the results of waterfowl breeding grounds census work for the spring of 1950 in Wisconsin. Four types of census work were done and are reported here, namely:

1. Cross-country automobile transects.
2. Cross-country aerial transects.
3. Aerial lake and marsh surveys.
4. River surveys.

As noted above, square miles on all the types of census were computed on the basis of 1/4-mile strips. The lake and marsh and the river surveys consisted almost entirely of shoreline checks flown at a distance of 220 yards from the shoreline.

Census routes followed were practically identical with those depicted on the map submitted with the 1949 report; consequently, no map of census routes accompanies this report. Although each region of the State is not represented on a basis commensurate with its size, yet census routes do cover over 50 of the State's 71 counties. Distribution of census routes tends to favor those areas which have proved to be more prolific duck producing areas in order to preclude the possibility of statistical error in evaluating population trends. Since Wisconsin's waterfowl habitat is relatively poor from the standpoint of local duck populations when considered on a State-wide basis, the aforementioned tendency to favor better areas is therefore a practical necessity if our census work is to be worthwhile in view of the limitations in manpower and funds provided to the waterfowl research project.

In general, the data presented in each of the above tables depict trends well. However, the following general explanatory comments and conclusions are offered for the guidance of the reader:

1. The waterfowl breeding population declined in Wisconsin in 1950. Ground and the lake and marsh surveys indicated comparable breeding densities with 1949, but river surveys and cross-country aerial transects indicated sharp declines. When we take into consideration the fact that several changes in method of operation and of computation tend to favor the 1950 data, slight though it may be, the conclusion that local duck and coot populations decreased is inescapable.

2. The total number of waterfowl on Wisconsin waters covered during the spring breeding grounds census increased. This increase is largely attributable to an increase in the transient diving duck population, or, expressed otherwise, to a delay beyond their usual spring departure dates. That late breeding species of puddle ducks (e.g., blue-winged teal) were often flocked and that they may have subsequently paired, selected territories, and nested in Wisconsin is a definite possibility. However, work conducted during the subsequent waterfowl production survey showed a sharp reduction in numbers of local teal, suggesting that the aforementioned flocked birds left the regions where censused and moved elsewhere.

Consequently, the slight increase in total duck numbers in Wisconsin during May seems directly attributable to a late spring migration.

3. The coot population in Wisconsin in May showed a perceptible decline when compared with data from 1949.

4. It was evident from an examination of data on species composition that the common mallard decreased most markedly with the black duck apparently paralleling the mallard decrease. Blue-winged teal at least held their own statistically and may have increased somewhat. The ringneck, Wisconsin's most common breeding diving duck, maintained the same breeding level as 1949. Other diving duck species

were present in greater numbers than during the census period of 1949. The greatest increase was observed in scaups which demonstrated gains in all survey methods save via cross-country aerial transects; and even by this method their representation was nearly the same as last year.

5. From an examination of all data, and from previous year's census work, it appears evident that cross-country ground transects and aerial lake and marsh surveys offer the most reliable indicators to trends in the waterfowl population in Wisconsin.

Waterfowl Production Survey, Spring and Summer, 1950

Introduction

No waterfowl production survey work has been conducted in Wisconsin by the Wisconsin waterfowl research project prior to 1950 that was of sufficient scope to give an accurate indication of actual waterfowl production. Work conducted in 1950 was of an exploratory nature, not fully State-wide in scope, and was relatively limited as compared with surveys in other States and Provinces. However, work which has been done is principally of a quantitative nature or is at least quantitative in approach and should give at least some indication of what has taken place in Wisconsin waterfowl production this year, particularly in southeastern Wisconsin.

It must be pointed out, however, that results of this survey are not necessarily in agreement with results obtained by the Wisconsin Game Survey Project through a survey conducted by the State Crop Reporting Service. This survey indicated a substantial gain in waterfowl production in Wisconsin in 1950. Moreover, reports received from game managers in the northern and central portions of the State indicate equal or better waterfowl production than during 1949. And if net production is comparable to last year, this reported increase from these areas seems warranted because much of the northern half of the State demonstrated an increase in numbers of breeding waterfowl in 1950, particularly in northeastern Wisconsin.

Data presented in this report represent the minimum known production. The Wisconsin waterfowl research project does not imply that data presented constitute actual production figures, but that these data do represent a minimum known production found through employment of methods of census described below.

Methods

Since this was a year of exploratory work on waterfowl production several types of coverage were employed on a limited scale in an effort to find out which types of census are most applicable to Wisconsin waterfowl habitat. They were:

1. Intensive ground coverage of all water areas in approximately two townships of land in Dodge County. (Small streams were not traversed on all coverages so are excluded from consideration in this report.)

2. Re-runs of automobile transects covered during the spring waterfowl breeding grounds survey.

3. Aerial coverage of 21 lakes, marshes, and rivers in Burnett County which were surveyed identically during the spring breeding grounds survey.

4. Ground checks of selected water areas known to support fair to good breeding populations of waterfowl this spring.

Due to limitations of space the following brief description of methods employed must suffice. Water areas were originally cruised between May 11 and 20, the second coverage was made between June 23 and July 4, and the third and final coverage between July 5 and 21. With the exception of re-runs of some portions of ground transects, practically all field work was conducted between the hours of 4:00 a.m. and 10:00 a.m. on the second and third coverages to enhance the probability of seeing broods.

Practically speaking, all census work conducted during this waterfowl production survey was an attempted 100 percent coverage. But it is evident that an element of error of unknown proportions may oftentimes be present; and it is improbable that all birds are ever seen by any method in view of the fact that many waterfowl tend to adopt skulking behavior during the nesting and brooding season. Such error would most probably be small for territorial and summering waterfowl, but would unquestionably be considerable for nesting and brooding females and their progeny, particularly during the early part of the broods' existence.

Results, Discussion, and Conclusions

The following data on broods was obtained:

Table 3. -- Brood Sizes and Ages

(Based on entire or complete brood counts)

Age Class	Number of broods	Total Young	Av. Brood Size
Ducks			
I (Downy young)	11	70	6.4
II (Intermediate)	22	135	6.1
III (Flappers)	26	155	6.0
Totals	59	360	6.1
Coots			
I	9	36	4.0
II	18	67	3.7
III	4	9	2.3
Totals	31	112	3.3

Note: Includes brood counts from other areas made by Wisconsin Fur Research Project.

Table 4. -- Chronology of Brood Observations

Period	Man Days	Duck Broods Observed Class I	Class II	Class III	Total
May 11 - 20	13	0	0	0	0
June 15 - 29	15	1	2	0	3
July 3 - 22	23	13	31	31	75
Totals	51	14	33	31	78

Since no extended discussion of phenology nor tables summarizing data on water conditions, territorial behavior, and population densities can be included in this brief report the reader is referred to the Wisconsin Pittman-Robertson Quarterly Progress Report of October 1, 1950, for additional information. Conclusions reached on the basis of the 1950 waterfowl production survey are as follows:

1. Water conditions were generally good in Wisconsin during 1950. Assuming that conditions encountered during the spring breeding grounds census constituted 100 percent of normality, water area decreased by about 50 percent in the northern portion of the State where transects were re-run, and to 58 percent of normal in central Wisconsin as the season progressed and as would be anticipated in an average year. Contrarily, the amount of water acreage in the southern portion of the State was brought up to normality or 100 percent by June rains and subsequent heavy rains in July temporarily increased water area acreages from 50 to 400 percent above normal.

2. The effects of heavy rains, windstorms, and subnormal temperatures on waterfowl production were undetermined. No evidence was available to prove that waterfowl brood losses occurred in the wild as a result of these climatological factors; in fact, the distribution of broods through all three age classes in comparable sized broods suggests that these young ducks survived adverse weather conditions readily. However, it is entirely possible that these climatological factors contributed heavily to breeding and nesting failures in the wild.

3. Minimum known waterfowl production in Wisconsin during 1950 constituted 1.34 young per adult pair on the breeding grounds during the peaks of the territorial periods for the various species of ducks. An upward revision of this ratio is unquestionably warranted since we do not know how many broods we fail to see by the methods employed.

4. A total of 185 breeding pairs tabulated on waterfowl production survey area censused produced a known total of 49 broods. An examination of data on territorial behavior for the various species suggests strongly that over 50 percent of the female ducks failed to bring off broods.

5. On the basis of 59 entire or complete brood counts made during the summer of 1950, duck broods averaged 6.1 young per brood. No valid difference in brood sizes existed between the various age classes. On the basis of 31 entire or complete brood counts on coots, an average of 3.3 young per brood was found.

6. The great majority of all broods were not seen until well into July. Few young birds were flying by July 22 and over half of all broods seen during July were of downy young (Class 1) or intermediate (Class 11) age.

7. It appears probable that net waterfowl production during 1950 in Wisconsin was lower than in 1949 solely on the evidence that the number of adult female birds seen flocked with summering males during June and early July was higher than has been observed in the past three years. Little other comparative data is available to substantiate this view other than spring breeding grounds census data which showed a definite decline in the number of breeding ducks.

8. A preliminary summary of goose nesting records in Wisconsin yielded only a handful of unconfirmed breeding records. It appears breeding records on Canada geese in Wisconsin are confined almost entirely to the Necedah National Wildlife Refuge, the Suamico Game Sanctuary near Green Bay, and to remnants of a few captive flocks in southeastern Wisconsin (free flying geese breeding in the wild).

Waterfowl Trapping and Banding Operations

Canada goose - Suamico Sanctuary - 12
Canada goose - hand reared - Horicon Marsh - 17
Mallards - hand reared - Horicon Marsh and Mississippi River at LaCrosse - 2,526
Wild ducks - Horicon Marsh - 833

A breakdown of all wild ducks trapped and banded at Horicon is as follows:

Species	Adult Male	Adult Female	Juv. Male	Juv. Female	Unsexed & Unaged	Total
Mallard	11	36	101	115	0	263
Black	3	4	33	18	1	59
Black-Mallard Hybrids	-	-	1	1	0	2
Pintail	-	-	2	2	0	4
Blue-winged teal	6	3	118	133	-	260
Wood duck	103	29	46	7	0	185
Redhead	-	-	5	6	0	11
Coot	-	-	-	-	32	32
Florida gallinule	-	-	-	-	17	17
Total	123	72	306	282	50	833

WATERFOWL
BREEDING GROUND
SURVEY
1950
MICHIGAN
GROUND CHECK AREAS
AERIAL SURVEYS
SPECIAL STUDY AREAS
Bob Hines.

Blank Page Digitally Inserted

WATERFOWL BREEDING GROUND SURVEYS IN MICHIGAN - 1950

Herbert J. Miller

Surveys of waterfowl breeding grounds were conducted by personnel of the Michigan Department of Conservation. The purpose of these surveys was to determine the comparative abundance of potential breeders and to measure the breeding success.

Methods Used in Sampling

A major portion of the waterfowl nesting habitat in Michigan is in the heavy cover of the forested regions. Water is not lacking with thousands of streams, lakes, swales and beaver ponds well scattered throughout the State. Breeding birds are scattered and difficult to locate as heavy cover is a serious limitation to accurate censusing. Because of these limitations our efforts have been confined to three types of surveys.

1. Aerial census of selected sample areas in the southern farm lands.
2. Surface censuses or ground checks on sample areas to obtain greater coverage of the State.
3. Brood censuses of the same sample areas to determine brood densities and survival.

These sample areas were carefully selected several years ago as the same surveys are made each year to provide a comparative index of changes in production. The standard methods of censusing have been employed. Judging from past experiences, roadside censuses appear impractical for the type of habitat found in Michigan. (See Figure 1 for locations).

Aerial Censuses

Aerial censuses on two sample areas have been made for three years to provide an index of change in potential nesting populations of southern Michigan farmland habitat. One area is in Barry County, the other extends through parts of Ingham, Livingston, and Oakland Counties. The Barry County check area shows a decrease as compared with last year but more birds than in 1948, while the second area shows a continuing increase in the potential nesting populations since 1948.

Results - Barry County Aerial Census Area

Year	Lineal Miles	Potential breeders per lineal mile
1948	234	0.10
1949	312	0.37
1950	300	0.16

Results - Ingham, Livingston, and Oakland Counties Aerial Census Area

Year	Lineal Miles	Potential breeders per lineal mile
1948	72	.55
1949	72	.68
1950	72	.79

Surface Censuses

Surveys made by boat on 13 sample check areas show an increase in the potential nesting population as compared with last year. These scattered check areas represent some of the better types of habitat within their respective locations in the State. Counts of local nesting ducks on 81 lineal miles of census line averaged 7.91 potential breeders per mile. The local breeders in 1949 averaged 6.8 per lineal mile.

Nesting Conditions

Cold weather and ice conditions delayed migration and nesting did not start until well into May. In general, nesting activities were approximately ten days later than that considered to be normal. Following the delayed spring break-up, water and weather conditions appeared to be favorable for waterfowl production. In the "Lake States," water areas are fairly stable and in general, even the swales retain water until broods are able to move to permanent water areas.

Brooding Surveys

Following the surveys to determine the potential breeding populations, brood censuses were made on the same sample areas to determine the successes of the hatch. The information obtained from these brood censuses proved to be disappointing in certain respects. A comparison of the results of the 1950 brood surveys to those of 1949 is shown below.

Results - Brood Censuses	1949	1950
Broods per lineal mile - - - - - - - -	.47	.34
Hen and young per lineal mile - - - -	2.75	2.32
Adults without broods per lineal mile	6.50	5.50

Fewer broods were observed this spring although the potential breeders determined by the previous survey appeared to be higher in 1950 than in 1949. It is important to note, however, that censuses in several important producing areas did not reveal a single brood, although broods were known to be present. Further evidence that broods are often unobserved in heavy cover typical of Michigan conditions is demonstrated by the results of a special study that was carried on this summer.

Special Study

The Ingham, Livingston, and Oakland County aerial census area was selected for a special study to determine the accuracy of various censusing techniques. Repeated ground checks and aerial censuses were made during the brooding period. Attempts to locate broods from the air on this 72 lineal mile census area previously covered to determine potential breeding population gave the following results:

June 5, Aerial Census -- No broods observed
June 18, " " -- Two broods observed
June 30, " " — No broods observed

Thirty lineal miles of ground check covering potholes, marshes, and lakes in the west end of the aerial census area revealed seven broods or 0.23 broods per lineal mile. Further intensive ground work on foot followed. This check verified locations of a total of 23 broods in the same area previously covered. This intensive ground work emphasizes that in dense cover only a small portion of the actual number of broods is revealed by a strip census. On the basis of this study, aerial brood

censuses to determine production in typical southern Michigan habitat appear questionable. The hatch was late this year and cover was heavy. These factors and the fact that aerial censuses were made in mid-morning should be taken into account in appraising these results.

Summary and Conclusions

On the basis of comparative results, assuming that errors were constant each year, the potential breeding population showed a slight increase, but the brooding success was below that of last year. It appears questionable whether accurate brood counts can be obtained in habitat typical of Michigan by aerial surveys.

WATERFOWL BREEDING GROUND SURVEY IN INDIANA - 1950

Russell E. Mumford

Essentially the same areas were surveyed this year as in 1949. A number of new study plots were established, however, and the number of river transects was increased from 5 to 13. Nine of these were censused the second time. Car transects on ditches were discontinued because they were found to be impractical except in a few counties. Field work was conducted from April 17 to July 20, 1950.

Further exploration was carried on in 15 northern Indiana counties, which make up the principal nesting range of all waterfowl in the State, except the wood duck. Some relatively good breeding areas were located which were unknown in 1949, and it is felt that future investigation must be conducted before an accurate appraisal of Indiana's nesting population can be obtained by a sampling technique.

The investigator had the assistance of various persons during this period. Ellison Madden and Richard Kizer each worked one month and lent valuable aid on float trips and study area censusing. In addition, Purdue University personnel, conservation officers, and Pittman-Robertson employees aided the work periodically.

Methods

All river transects were run by canoe and outboard motor, the motor being used whenever possible.

Study area plots in 12 northern Indiana counties were covered on foot at least twice during the summer. Since these were, for the most part, also censused in 1949, some trend information was obtained.

Canada goose nesting on the Jasper-Pulaski State Game Preserve was checked during the last of April and the first week of May. Practically all of the large marsh on this area was waded from time to time in search of waterfowl nests or broods.

Study areas were intensively covered by wading. A two-man crew circled the pothole and "beat out" any brushy area which might harbor a brood.

Areas and transects run in 1949 and 1950 have been underlined on the map (Figure 1).

Populations

It was planned to begin river float trips on April 1, but heavy rains in late March kept rivers above flood stages throughout the first two weeks in April. From April 17 to May 18 transects were taken on 13 rivers over the State. In all, 167 miles of stream were censused.

Many migrant species were encountered during this period, principally blue-winged teal, which apparently rely heavily on stream courses as migrational flight lines. The coot and 16 species of ducks were recorded during the above sampling (Table 1). A second coverage was made on 9 of the above rivers between May 23 and July 10. The adult waterfowl composition was quite different during this period.

The average number of wood ducks per mile for the first coverage was 1.2, for all 13 transects. Most of the transects included in the first coverage were

exploratory and 4 of little value were not included in the next coverage. For the 9 rivers run the second time, representing 123 miles, the average was 1.0. Whereas woodies made up only 28.3 percent of the total waterfowl observed on the first census, they comprised 93.7 percent during the second check. Of interest is the fact that the ratio of drakes to 100 hens dropped from 223 to 50 for the two coverages, respectively.

Except for one hooded merganser brood, no other species were noted as nesting along streams.

Table 1. -- Adult Waterfowl Composition, By Species, On First Coverage Of 13 River Transects, April 17 - May 18, 1950, And Second Coverage Of 9 River Transects, May 23 - July 10, 1950 - Indiana

	COVERAGE		COVERAGE	
	First	Second	First	Second
Species	Total Ducks	Total Ducks	Percent Of Total	Percent Of Total
Mallard	31	0	4.4	-
Black duck	12	1	1.7	-
Gadwall	1	-	-	-
Baldpate	6	-	-	-
Green-winged teal	6	-	-	-
Blue-winged teal	412	-	58.4	-
Shoveler	2	-	-	-
Wood duck	200	120	28.3	93.7
Ring-necked duck	4	-	-	-
Canvasback	1	-	-	-
Lesser scaup	7	2	-	-
Am. golden-eye	3	-	-	-
Ruddy duck	1	2	-	-
H. merganser	11	2	-	-
Am. merganser	5	-	-	-
Red-br. merganser	4	-	-	-
Unidentified	-	1	-	-
Total Ducks	706	128		
Coot	59	2		

A total of 60 broods was observed on the 123 miles of rivers censused between May 23 and July 10 (Table 2). The number of ducklings in these broods totaled 402, for an average of 6.7 per brood. All broods were Class 1. In 1949, the average of 35 Class 1 broods recorded on river transects was 6.0 young per brood.

Since many river transects were run for the first time this year, no comparison can be made with 1949. However, 2 transects were censused both in 1949 and 1950. On the Muscatatuck, 19 broods were recorded in 1949 and 21 broods in 1950. The Elkhart produced 6 broods in 1949 and 4 in 1950.

The number of wood ducks produced on rivers in 1950 is thought to be about equal to that in 1949.

Table 2. -- Waterfowl Observed On River Transects[1] In Indiana During 1950 Breeding Ground Survey

Transect (rivers)	Date	Mileage	Ducks	Coot	Broods	No. of Young	Ducks Per Mile Adult	Ducks Per Mile All Ages
1R Muscatatuck	4/19	14	133	48	1	2	9.5	9.6
	5/25	14	36	-	21	144	2.6	12.9
3R Wabash	5/ 2	12	180	20	-	-	15.0	15.0
5R Elkhart	5/12	17	19	-	-	-	1.1	1.1
	6/29	17	5	-	4	23	0.3	1.6
6R Big Blue	4/26	12	41	4	-	-	3.4	3.4
	6/14	12	17	-	11	72	1.4	7.4
7R White	4/27	20	50	-	-	-	2.5	2.5
	5/24	20	26	-	2	19	1.3	2.3
8R Eel	4/17	13	40	2	-	-	3.1	3.1
	5/23	13	18	1	7	43	1.4	4.7
9R Sugar Creek	5/ 2	8	13	-	-	-	1.6	1.6
	7/10	8	5	-	-	-	0.6	0.6
10R Mississinewa	5/ 9	13	17	-	-	-	1.3	1.3
	6/ 9	13	15	1	9	66	1.2	6.2
11R Salamonie	5/10	15	14	-	-	-	0.9	0.9
12R Whitewater	4/25	7	13	-	-	-	2.0	2.0
13R Tippecanoe	5/ 5	12	23	-	-	-	2.0	2.0
	7/10	12	0	-	-	-	0	0
14R Iroquois	5/ 4	14	79	-	-	-	5.6	5.6
	7/ 7	14	9	-	6	35	0.6	3.1
15R Pigeon	5/18	10	18	-	-	-	1.8	1.8

1. Transects 2R and 4R not run in 1950.

The same study areas were censused in 8 northern Indiana counties in 1949 and 1950. Waterfowl populations on these areas have been compared (Table 3). Although the number of ducks-per-square-mile vary greatly from one year to the next for some species and areas, there were 13 broods observed on the areas during both years.

Table 3. -- Comparison of Study Area Plots[1] Northern Indiana -- 1949 and 1950

Area	Date	1949 Totals[2] Sq. Mi.	Ducks	Coot	Ducks Per Sq. Mi.	1950 Totals[2] Ducks	Coot	Ducks Per Sq. Mi.	Date
1S	5/19	4	23	-	5.7	25	12	6.3	5/18
	6/14	-	14	-	3.7	70	20	17.5	6/26
	7/26	-	33	-	8.2	29	15	7.3	7/11
2S	5/19	2	32	-	16.0	13	5	6.5	5/18
	6/15	-	33	-	16.5	18	12	9.0	6/27
	7/26	-	24	-	12.0	17	20	8.5	7/11
3S	5/31	1	9	-	9.0	4	-	4.0	5/29
	7/ 7	-	0	-	0	2	-	2.0	7/ 6
4S	6/ 1	1	1	-	1.0	2	-	2.0	5/15
	7/ 6	-	22	-	22.0	0	-	0	6/30
6S	5/13	5	27	6	5.4	34	9	6.8	5/17
	6/28	-	71	13	14.2	57	3	11.4	6/20
7S	5/20	1	23	-	23.0	11	-	11.0	5/11
	7/15	-	13	-	13.0	11	5	11.0	6/28
8S	6/14	1	3	-	3.0	6	-	6.0	5/19
	7/25	-	0	-	0	0	-	0	6/27
9S	6/ 2	1	5	-	5.0	0	-	0	5/15
	7/ 6	-	8	-	8.0	14	-	14.0	6/30

1 - 5S discontinued in 1950.
2 - Includes young in broods (coot omitted).

Species composition comparisons show decreases for the mallard, black duck, and wood duck. Blue-winged teal remained about the same, and coot exhibited an increase (Table 4). Apparently the excess water in potholes during the 1950 nesting season was a factor in holding nesting coot. The above mentioned 5 are the only species found to be nesting on study areas.

On the basis of total pairs (calculated from pairs plus lone drakes), mallards decreased over 50 percent and blue-winged teal increased slightly (Table 5). It is thought, however, that the greater number of available water areas in 1950 might have dispersed loafing mallard drakes. Mallard broods observed on the areas numbered the same in 1949 and 1950.

Table 4. -- Comparison of Species Composition on the Same Study Areas, Northern Indiana, 1949 and 1950

Species	1949 (May 13 -- June 14) No. of Ducks	1949 (May 13 -- June 14) Percent Of Total	1950 (May 11 -- 29) No. of Ducks	1950 (May 11 -- 29) Percent Of Total
Mallard [1]	35	34.3	16	16.3
Black duck [1]	8	7.8	1	1.0
Gadwall	0	-	2	2.0
Baldpate	0	-	1	1.0
Pintail	1	1.0	0	-
Blue-winged teal [1]	35	34.3	48	49.0
Shoveler	0	-	2	2.0
Wood duck [1]	11	10.8	5	5.1
Ring-necked duck	1	1.0	4	4.1
Canvasback	1	1.0	1	1.0
Lesser scaup	6	5.9	17	17.4
Bufflehead	0	-	1	1.0
Ruddy duck	3	2.9	0	-
H. merganser	1	1.0	0	-
Total ducks	102	100.0	98	100.0
Coot [1]	8		26	
Canada goose	1		0	

1. Breeding species - all others considered non-breeders.

Table 5. -- Comparison of Calculated Total Pairs of Breeding Waterfowl on Same Study Areas, Northern Indiana, 1949 and 1950

Species	1949 Males	1949 Pairs	1949 Un-sexed	1949 No. of Pairs	1950 Males	1950 Pairs	1950 Un-sexed	1950 No. of Pairs
Mallard	20	6		26	8	2	4	10
Black duck	1	2		3	1			1
Blue-winged teal	17	9		26	13	17		30
Wood duck	7	2		9	5			5
Coot			8				26	

Although 37 percent more blue-winged teal was recorded on the study plots in 1950, 17 pairs were included, as compared with only 9 pairs in 1949. The corrected number of total pairs based on observations of lone drakes and pairs was 26 and 30 for 1949 and 1950 respectively; so little actual change resulted. The 1950 censusing was done earlier in the season before hens had commenced incubating. More teal broods were located in 1950 by the use of a two-man crew, as compared with censusing by one man the previous year.

Species composition on all study areas, including those above and new ones established this year, reveals considerable fluctuation between the first and second coverages (Table 6). These data indicate that migrant species were lingering in northern Indiana throughout the summer. Lesser scaup constituted the major portion of such birds, especially during the latter half of May.

Mallards and wood ducks increased 15 and 17 percent, respectively, on the second coverage. Black ducks and blue-winged teal percentages revealed little change and coot increased slightly. Other species, being non-breeders, warrant little discussion. It should be pointed out that the increase in mallards is due to a flock of 11 birds being observed on one study area during the second visit. These were probably transient birds. The number of loafing and molting drakes accounts for the increase in wood duck numbers - one small study plot producing 14 males on the second census.

Table 6. -- Adult Waterfowl Composition, By Species, On All Study Areas - Northern Indiana - 1950

Species	First Coverage May 11-29	Second Coverage June 20-July 10	Percent of total (first)	Percent of total (second)
Mallard	16	30	8.8	24.2
Black duck	1	1	0.6	0.8
Gadwall	2	0	1.1	-
Baldpate	3	0	1.7	-
Blue-winged teal	70	44	38.7	35.5
Shoveler	2	0	1.1	-
Wood duck	11	29	6.1	23.4
Ring-necked duck	3	3	1.7	2.4
Canvasback	1	0	0.6	-
Lesser scaup	70	9	38.7	7.3
Bufflehead	2	0	1.1	-
American golden-eye	0	1	-	0.8
Ruddy duck	0	4	-	3.2
Hooded merganser	0	3	-	2.4
Total	181	124	100.0	100.0
Coot	76			

Weather and Water Conditions

The last week of March was marked by heavy rains which brought rivers above flood stage throughout the State. March temperatures averaged 3.9 degrees below normal.

April was the third coldest on record in 64 years, and very wet. At Angola, situated near some of the best waterfowl breeding range in the State, 8.28 inches of rain were recorded during the month. Temperatures averaged 5.6 degrees below normal and a severe ice storm occurred on April 9. Vegetative growth was retarded from 2 to 3 weeks in northern Indiana and potholes were flooded. An abundance of temporary potholes were formed by excess surface water, especially in wheat and other cultivated farm fields.

May and June temperatures were near average, in general, but potholes still remained full until about July 1. During the first week of July, rainfall was slight and water levels began to fall. Young mallards, black ducks, and wood ducks were capable of flight by this time and the first blue-winged teal broods were nearly at flight stage.

The excessive amount of water probably was to the advantage of nesting waterfowl. The fact that potholes were already flooded in April might have decreased losses from inundation of nests. No such nests were located.

Success of the Season

Mallards and black ducks began laying the first week of April, with the hatching peaks for both species falling around mid-May. Early-hatched mallards were flying by July 4, and young blacks were first observed capable of flight on July 10. A brood of mallard ducklings, a few days old, was reported in Tippecanoe County on July 15. The investigator observed a hen mallard with one 4-week old duckling on August 14.

The blue-winged teal migration through extreme southwestern Indiana began March 14 - one day earlier than last year, and peaked about mid-April. On May 29 and 30, foot-censusing in northwestern Indiana revealed 5 nests, some of which were incubated. The first of these nests hatched on June 20. In northeastern Indiana 6 teal broods were observed on June 26. Egg laying was calculated to have begun about May 18 for the oldest and May 27 for the youngest brood. These nests probably hatched between June 19 and 24. No young teal were observed flying prior to July 20.

Wood ducks were first noted in the State on February 21, 2 days later than in 1949. The first brood was observed on April 18, in southeastern Indiana, thus egg laying was computed to have begun on March 16 for this brood. However, the peak of egg laying in southern Indiana was computed to have been reached from April 10-20. Egg laying in the northern half of the State probably reached its peak during the first two weeks of May. Flying young were first observed in northern Indiana on July 4, but undoubtedly, young were on the wing before this date in the southern half of the State.

Canada geese were first noticed in the territory at the Jasper-Pulaski State Game Preserve on March 10. Between April 20 and May 3, 15 nests with complete clutches were located. The first brood was noted on May 3.

The only hooded merganser brood was observed on June 14 and was estimated to have been about six weeks old.

Stragglers of 11 species were present throughout the nesting season. These included gadwall, baldpate, green-winged teal, shoveler, ringneck, canvasback, lesser scaup, bufflehead, ruddy, American merganser, and American golden-eye. There was no evidence that any of the above species nested in the State.

Waterfowl brood counts, by age classes in 1949 (Table 7) are compared with 1950 (Table 8).

It should be noted that all brood figures include part and complete broods (single ducklings being included as a brood in some instances). Since this was true in 1949 and 1950, brood averages have been computed on the same basis.

Table 7. -- Waterfowl Brood Counts, All Areas, Indiana - May 1 - July 31, 1949

Species	Broods Class 1	Brood Av.	Broods Class 11	Brood Av.	Broods Class 111	Brood Av.	Total Av.
Mallard	9	6.6	1	5.0	4	7.8	6.8
Black duck	-	-	1	4.0	-	-	4.0
Blue-winged teal	1	12.0	-	-	-	-	12.0
Wood duck	46	7.0	3	3.7	7	7.3	7.0
H. merganser	2	7.0	-	-	-	-	7.0
Canada goose	4	2.5	1	3.0	-	-	2.6
Total	62		6		11		

Table 8. -- Waterfowl Brood Counts, All Areas, Indiana - April 18 - July 20, 1950

Species	Broods Class 1	Brood Av.	Broods Class 11	Brood Av.	Broods Class 111	Brood Av.	Total Av.
Mallard	4	6.8	1	8.0	1	4.0	6.3
Black duck	-	-	1	6.0	1	7.0	6.5
Blue-winged teal	8	9.3	2	7.5	3	8.6	8.6
Wood duck	62	6.8	10	5.6	5	6.2	6.6
H. merganser	-	-	1	2.0	-	-	2.0
Canada goose	1	1.0	7	2.4	-	-	2.2
Coot	4	4.5	5	5.6	-	-	5.1
Total	79		27		10		

At the Jasper-Pulaski Game Preserve, 15 complete clutches of Canada goose eggs averaged 4.6 eggs per clutch. The average brood size for 8 Class 1 and Class 11 broods was only 2.2, however. Unfortunately, it was not possible to obtain data on hatching success. Some evidence of predation was noted - one nest being torn apart and the eggs scattered about unbroken.

The high raccoon population on this property may have been a detriment to nesting wood ducks. Three nests out of 8 under observation in boxes were destroyed by this predator.

It appears that blue-winged teal broods enjoyed a higher rate of survival than other species under observation this summer. A hen blue-winged teal with 10 downy young was observed on June 26. On July 11 she was again located and had all 10 ducklings with her. Three blue-winged teal nests containing an aggregate of 26 eggs produced 25 ducklings. Downy broods of 7, 10, 10, 12, 12, and 13 indicated hatching success of blue-wings to be relatively high. One nest under observation was broken up by an unknown animal predator which killed the hen and took 5 eggs (Table 9).

Table 9. -- Nesting Success, Northern Indiana, 1950

Species	Date Found	No. of Eggs	Fate
Mallard	June 24	8	Taken by farmer, put under hen
Blue-winged teal	May 30	2	Unknown
"	May 30	6	Hatched 5 - June 21, 1 infertile
"	June 21	12	Unknown
"	June 20	12	Hen killed, 5 eggs missing June 22
"	May 29	9	All hatched June 20
"	June 22	12	Unknown
"	June 22	11	Unknown
"	May 29	6	Unknown
"	May 30	11	All hatched by June 21

Summary

Indiana's second annual breeding ground survey was conducted from April 17 to July 20. River transects, foot-censusing of selected study area plots, and further investigations of new areas were carried on. Ditch transects were discontinued.

Breeding species encountered were the mallard, black duck, blue-winged teal, wood duck, hooded merganser, Canada goose, and coot, in order of importance. The blue-winged teal, mallard, and wood duck were the most important nesting waterfowl on study areas in northern Indiana. Blue-wings made up 49 percent of the nesting population of these areas.

Weather had no apparent effect on nesting but retarded migration of non-breeders. The excess of water, which flooded potholes, came in April, thus lessening danger from flooding. It may have been a factor in holding coot to nest. In general, water conditions were very favorable to nesting waterfowl.

The first wood duck brood hatched about April 16.

No summer banding was done.

The number of adult wood ducks per linear mile of stream ranged from 0.2 to 3.4, with an average of 1.2. Ducks per square mile on study areas ranged from 0 to 17.5, as compared with a range from 0 to 23 in 1949. Brood production was identical with that of 1949. Coot showed a marked increase over 1949 on study areas.

WATERFOWL BREEDING GROUND SURVEY IN OHIO - 1950

John M. Anderson

In 1949 the private shooting clubs which employ the writer, authorized a breeding ground survey of the southwestern Lake Erie region. The region involved consists of a strip of marsh along the southwest corner of Lake Erie, between Toledo and Sandusky, roughly 30 miles long and a mile wide. Water areas included in the survey were of three categories; temporary roadside ponds, artificially flooded marshes, and natural marshes. Coverage was by boat and on foot. On marshes of more than 2,000 acres, a square-mile block was sampled. On marshes ranging from 2,000 acres down to 500, a block of 160 acres was sampled. On smaller areas, the entire area was covered. Six roadside ponds, 13 artificially flooded marshes of 40 acres or less, and 10 marshes of from 500 to 2,800 acres were sampled. There were no non-productive areas, such as upland or the open water of Lake Erie and Sandusky Bay included in the survey. A total of 2,272 acres was covered, representing roughly 12 percent of the entire region. Identical areas and sampling methods were employed in 1949 and 1950.

Table 1. -- Breeding Pairs on 2,272 Acres of Marshland

Species	Pairs	Pairs Per Sq. Mi.	Percent Change
	1949:1950	1949:1950	
Mallard	100:77	28.2:21.7	decrease 23
Black duck	52:38	14.6:10.7	" 26
Pintail	4: 3	1.3: 0.9	" 25
Blue-winged teal	21:22	5.6: 6.2	increase 4
Wood duck	6:20	1.7: 5.5	" 333
Totals	183:160	51.5:45.1	decrease 12

Table 1 shows the species composition and number of breeding pairs per square mile in 1949 and 1950. A 12 percent decrease in total pairs per square mile is shown by the data. Mallard pairs per square mile decreased 23 percent; blacks decreased 26 percent; pintails decreased 25 percent; while blue-winged teal and wood ducks increased 4 percent and 333 percent respectively.

Water and Weather Conditions

Throughout the nesting season, the level of Lake Erie was roughly one foot higher than during the same period in 1949. This decreased the number of loafing and nesting sites in most of the larger marshes. Damage from flooding during seiches caused by northeast winds, however, was slight in 1950. Generally speaking, water and weather conditions were favorable throughout the spring and summer months.

Spring was about two weeks later than in 1949, and an apparent migration barrier caused the migrants to "pile up" in the region in unprecedented numbers.

Nesting Success

It was impossible to spend sufficient time in the field during June and July to gather adequate data on the number of broods per square mile for comparison with 1949. A sufficient number of broods was seen, however, to indicate that the average size of Class 111 broods was 6.0 as compared to 6.2 in 1949.

The predator population was roughly the same in 1949 and 1950. The populations of raccoon, opossum, and skunk were very high, while the number of breeding crows and the nesting success of crows were much below "normal". Only two crow nests were successful out of 20 under observation in Ottawa County, according to a study made by Mr. Laurel Van Camp.

Summary

The mallard, black duck, blue-winged teal, wood duck and pintail, in order of abundance, nested in the Lake Erie region of Ohio in 1950. A total of 160 pairs of these species was recorded on 2,272 acres of marshland, or 45.1 pairs per square mile, as compared with 183 pairs, or 51.5 pairs per square mile, in 1949.

Comparable data on number of broods per square mile are lacking for 1950, but the average brood size showed no significant change. Since the environmental factors affecting nesting success appeared to be comparable to 1949, it is inferred that the 12 percent decrease in number of nesting pairs was probably reflected in the total production for the region.

WATERFOWL BREEDING GROUND SURVEY IN NORTHEASTERN STATES - 1950

C. E. Addy

Introduction

In the same manner as last year, surveys in the northeastern States were conducted by cooperators consisting of personnel of the State Fish and Game Departments, the Fish and Wildlife Service, various ornithologists and sportsmen. For the spring breeding ground survey 126 areas, identical with those of last year, were covered. In addition, reports were received on 143 other areas, most of them new for this year.

Cooperators made summer brood counts on 118 areas comparable to those covered last year. In addition, reports were received on 123 other (mostly new) locales.

The coverage needed is still far too limited in most States. However, the various fish and game departments are gradually incorporating annual breeding ground surveys in their regular operations. It is hoped that by next year all of the State game departments will be in a position to greatly expand their breeding ground program.

Methods and Areas Covered

Although progress has been made in the cooperative breeding ground studies in the Northeast, there is still considerable need for improvement in techniques and methods. Experimentation with overland transects in hilly country has yielded very low counts, but on the more extensive flat tidal marshes of the Delaware and Chesapeake Bay areas the transect method has proved more successful. Therefore, since the transect method has its limitations, the principal method resorted to has been the more or less complete coverage of definite areas by both aerial and ground observation.

In the northeastern States, spring and summer surveys were conducted on the same individual habitats as last year by cooperators. In addition, the program has been enlarged to include many new areas. These surveys are made largely by ground observation. However, it is believed that the use of the airplane will assume more importance in the future. The game departments of both Delaware and Maryland have done excellent work with aerial coverage this year and it is expected that other States in the Northeast will eventually utilize the plane wherever possible to supplement ground observation.

Following is a tabulation of the number of areas surveyed in each State, including areas new for this year. The number of areas listed is indicative to some extent of the amount of coverage in each State, but not in every respect. For instance, relatively few areas are listed for Delaware and Maryland, but the greater part of the waterfowl habitat was covered by aerial surveys in these States. In other States where ground observations were made, such as New York where 30 areas are listed, only a minor percentage of the waterfowl habitat has been surveyed.

Number of Areas Surveyed by State

	Spring Survey		Summer Survey	
	A	B	A	B
Connecticut	48	1	31	8
Delaware	1	5	5	8
Maine	8	21	5	15
Maryland	12	17	0	10
Massachusetts	14	13	6	5
New Hampshire	5	7	39	18
New Jersey	8	6	6	10
New York	17	31	13	30
Pennsylvania	6	20	6	6
Rhode Island	4	11	2	8
Vermont	3	2	5	2
Virginia	0	1	0	0
West Virginia	0	8	0	3

A - Surveys made on comparable areas last year
B - Surveys made on new areas

Weather and Water Conditions

The usual unpredictable New England spring weather prevailed. Although the average precipitation in the New England States was generally below normal, there were many scattered light rains and much cloudy weather giving the impression of excessive precipitation.

Temperatures averaged several degrees (.4 - 4.8) below normal from March to May. Cold predominated until the last of May, and the month of June was generally warm and sunny. Generally speaking, the average temperature gives little indication of actual conditions for there were frequent periods of unusually low temperatures interspersed with warm spells of relatively high temperatures.

The spring run-off followed the usual pattern with floods occurring in only a few localities. It was the consensus of opinion that the early rise of water levels had little effect on nesting. The breeding season was retarded 10 days or more this year and nesting was not well under way prior to the spring freshets. In many sections water levels remained relatively high, making detection of broods difficult.

Nearly all reports from cooperators indicated excellent weather conditions for nesting and brood production.

Breeding Population Trends

Table 1 lists by species, and for all ducks combined, the percentage increase or decrease in breeding pairs and total ducks as reported by cooperators in the northeastern States. Counts were made on definite tracts in the same manner as last year.

Since the number of areas studied is relatively small, it is possible that the percentages given may not be representative in all instances. However, it is believed that the increase shown does represent the actual trend, particularly for the black duck. Statements from nearly all cooperators indicated an exceptionally good spring population with breeding conditions excellent.

Production Trends

Table 2 gives by species, and for all ducks, the percent increase or decrease in summer production in the northeastern States. Here, again, the data have been furnished by cooperators who made counts on areas comparable to those covered last year. As with the spring surveys, the limited number of areas involved necessitates caution in accepting the data as representative. This is particularly true for the less common species such as the teal, golden-eye, ringneck, and gadwall. It is believed that the reduction in numbers observed was due in part to the high water levels in the northern part of the range. A number of observers remarked about the difficulty in locating birds which were using the flooded marginal vegetation this year. This, coupled with the fact that hatching was 10 days or more late this year, made estimates of production difficult. However, inasmuch as the climatic conditions and watersheds were ideal for the nesting and brooding season, it is reasonable to assume that production has actually been materially better than the survey figures show. It is believed that the over-all production is as good as last year. Perhaps an indication of this is shown by the intensive studies of the Maine Cooperative Wildlife Research Unit on certain marshes in eastern Maine. These studies indicate the best production in 14 years.

In the cooperator summer surveys 766 complete broods were tallied. The number of broods and the average size brood by species are as follows:

Black	345	6.3
Wood	226	6.8
Mallard	109	6.1
Gadwall	20	7.4
B-w. teal	38	5.4
Golden-eye	23	5.2
Ringneck	5	7.6

Brood sizes in Rhode Island were considerably lower than in other States, averaging 4.3 for black ducks. Excluding the Rhode Island data (78 broods), the regional average for black ducks would be 6.8.

When broken down into age classes there is relatively little difference in the average size of brood and frequently the brood tends to increase in number of young with age.

Summary of Breeding Ground Surveys

The spring breeding surveys in the States indicated a strong upward trend in the population. This was particularly true with the black duck and wood duck, which make up most of the breeding population in the region.

The summer brood surveys indicate a slight to moderate decrease for most species except the blue-winged teal and ringneck. However, the actual production was undoubtedly higher because of the limitations on observation brought about by high water.

Table 1. -- Percent Increase or Decrease in Spring Breeding Population in Northeastern States - 1950

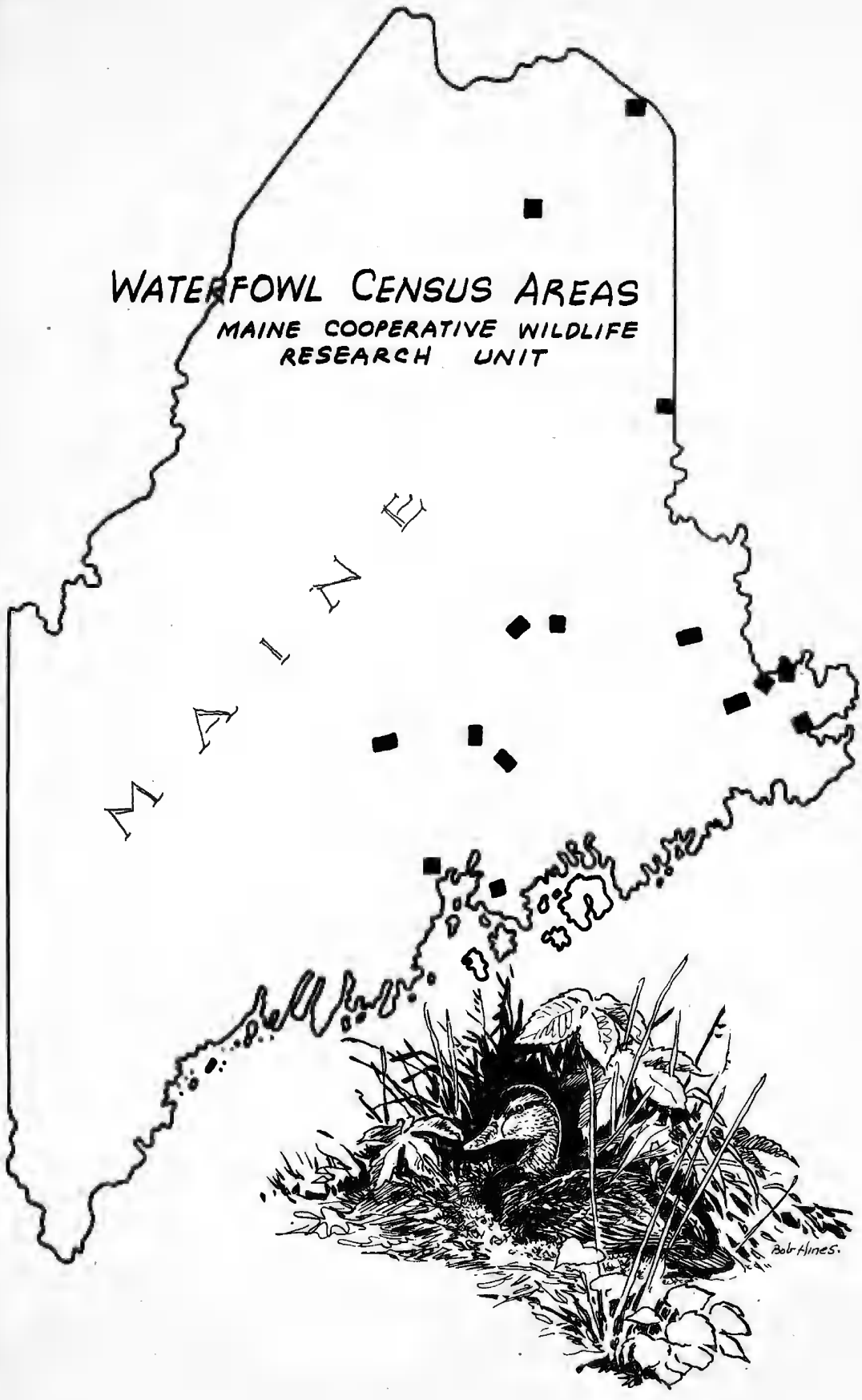
Species	Pairs	Total Ducks
Black	+ 11	+ 31
Wood duck	+101	+ 70
Mallard	- 28	- 19
Gadwall	- 50	+ 6
B-w. teal	+ 10	+ 10
Golden-eye	+ 45	- 46
Ringneck	n.c.	- 25
All ducks	+ 12	+ 19

Table 2. -- Percent Increase or Decrease in Summer Production in Northeastern States - 1950

Species	Broods	Total Ducks
Black	+ 2	- 21
Wood duck	- 7	- 11
Mallard	- 5	- 4
Gadwall	- 22	- 18
B-w. teal	+ 52	+ 58
Golden-eye	- 6	- 32
Ringneck	+100	+ 53
All ducks	- 1	- 11

Spring Breeding Survey: No. Areas used in this report - 115
No. additional areas (mostly new) reported on, but not included here - 129

Summer Brood Survey: No. Areas used in this report - 112
No. additional areas - (mostly new) reported on, but not included here - 136


WATERFOWL CENSUS AREAS
MAINE COOPERATIVE WILDLIFE
RESEARCH UNIT
MAINE
Bob Hines.

Blank Page Digitally Inserted

WATERFOWL BREEDING GROUND SURVEY IN MAINE - 1950

Howard L. Mendall

For several years, as part of its general program, the Maine Cooperative Wildlife Research Unit has conducted a life history and management study of the important game ducks breeding in the State. In the order of their abundance, these species are: black duck, ring-necked duck, wood duck *, American golden-eye, blue-winged teal, and green-winged teal. Of these ducks only the first four mentioned are common residents. The two teal are scattered throughout the State but nowhere are present in appreciable numbers. Therefore, census data relative to teal in Maine have little practical significance.

The following report summarizes the results of the 1950 breeding studies, and covers the period from April to late September. The writer was assisted on this project by the following staff members: D. A. Benson, M. W. Coulter, F. T. Haseltine, J. W. Peppard, and J. D. Rearden.

Coverage and Techniques

Coverage in 1950 was identical to that of 1949. The study areas on which data were obtained are indicated on Figure 1. For a general description of waterfowl breeding habitat in Maine the reader is referred to the 1948 report.

Techniques of study remained relatively unchanged from those of the past few years. These are:

1. A count of territorial males and pairs prior to and during the early stages of nesting. These counts are made by boat or on foot.

2. A sample nesting study.

3. Population and brood checks carried out several times on each area from June through August. These counts are likewise made by boat or on foot. (This year, on some of the areas it was possible to carry out these checks through most of September).

Breeding Populations - 1950

When final census data were compiled it was found that the population of breeding ducks in Maine had shown an increase for the fourth consecutive year. The heavy gain for the blue-winged teal must be interpreted in the light of a small sample, but was gratifying nevertheless. Of much greater significance was a 7 percent increase in the black duck. The fact that this species showed an increase for the fourth consecutive season was especially encouraging. Likewise, of considerable interest was the gain made by the wood duck this year, and which followed the very heavy increase (52 percent) of 1949. Wood ducks now appear to be making a very satisfactory recovery from their alarming scarcity of the period 1945 - 1947.

The only pessimistic aspect of the 1950 census data occurred with the American golden-eye. The slight gain made by the species in 1949 was more than offset by a 10 percent decrease this year. Breeding golden-eyes now appear to be at the lowest level in the State that they have reached at any time during the past 14 years.

****

* In contrast to listings of previous years, it appears that the wood duck replaced the golden-eye in 1950 as third species.

The following tabulation gives the 1950 census figures for the six breeding species of ducks - excluding mergansers:

Species	Status in 1950
Blue-winged teal	50% increase
Black duck	7% increase
Wood duck	6% increase
Ring-necked duck	1% increase
Green-winged teal	No change
American golden-eye	10% decrease

A breakdown of census data, by areas, is presented in Table 1 for the two most numerous species - the black duck and the ring-necked duck. The data are given for five years because they show the trend from the 1946 low point.

The Nesting Season

The spring season was somewhat retarded from the average in Maine this year and greatly retarded from 1949. The break-up of ice in the principal waterfowl breeding areas of the State took place from 6 to 15 days later than a year ago, and the migration, as well as nesting, was correspondingly later. This fact proved to be very desirable, however, for heavy floods occurred from April 21-23 which, under normal conditions, would have caused serious nesting losses to black ducks. As it was, very few ducks had started to nest at the time of the flood. Therefore the only noticeable effect of the spring climatic conditions was a retarded nesting season for the early breeding species -- black ducks, wood ducks, and golden-eyes. The late breeding birds (ringnecks and the two teal) nested at nearly average times.

Following the April flood precipitation was light and the water levels remained good throughout the entire brood season.

As would be expected, hatching peaks were much later than a year ago. For black ducks this peak appeared to be about June 12 - 2 1/2 weeks later than in 1949 and a week later than in 1948. The heaviest hatching of wood ducks occurred about June 18 - 2 1/2 weeks later than in 1949 and about 10 days later than in 1948. By contrast, the normally late nesting ring-necked ducks reached their hatching peak at approximately June 30 - only 5 days later than in 1949 and actually 2 days earlier than in 1948.

During the sample nesting study, a total of 92 nests was located; 85 of these were of 3 species - ring-necked duck, black duck, and wood duck.

Periodic checks were kept of 89 of the nests until hatched or destroyed. Hatching success was 74 percent (66 nests). This represents the highest hatching rate recorded at any time during the 14 years of the Unit's waterfowl program.

Flood losses were of little significance, accounting for only 3 of the 23 nest losses and were all confined to one marsh in eastern Maine. Predation was lighter than a year ago and was caused primarily by the mink, raccoon, and crow. Few losses occurred from the activity of the red fox this year, in contrast to the situation of 1949.

The Brood Season

Apparently because of the much later hatching this year, as well as the slightly higher water levels that prevailed, fewer complete broods were located during the time available for study. A total of 176 broods, where complete counts were believed made, were classified on an age basis. The average size of 46 Class 111 broods (young at or

approaching the flying stage) was 5.6 young per brood. This was nearly equal to the record high of 1949 (5.7) and was considerably above the long-term average in Maine.

Summary and Conclusions

1. The status of breeding waterfowl in Maine at the start of the 1950 nesting season was better than in 1949; this makes the fourth consecutive year of such an increase. Only the American golden-eye was noted in fewer numbers.

2. Climatic conditions were very favorable during both the nesting and the brood period.

3. The retarded spring season resulted in rather late hatching, but this did not appear to have any harmful effects.

4. Nesting success, as based on a sample study, was 74 percent - the highest figure recorded in 14 years.

5. Brood success was higher than in an average year and practically as high as in the record year of 1949.

Table 1. - Waterfowl Census Data -- Number of Breeding Pairs
(Black Duck and Ring-necked Duck Only)

	Black Duck Pairs					Ring-neck Pairs				
Study Area	1946	1947	1948	1949	1950	1946	1947	1948	1949	1950
St. John River, Van Buren	2	4	3	4	6	--	--	--	--	--
Portage Lake, Portage	6	4	3	6	4	14	20	21	19	20
Meduxnekeag Strait, Hodgdon	2	3	4	6	5	--	--	--	--	--
Musquash Strait, Gr. Lake Strait	4	4	5	7	10	3	5	6	6	9
Pocamoonshine Area, Alexander	10	15	15	18	22	28	28	40	35	32
St. Croix River, Baring	9	8	9	8	8	--	--	--	--	--
Moosehorn Refuge, Calais	16	27	31	24	22	8	9	8	19	17
Pennamaquan River, Pembroke	2	2	2	3	4	10	13	20	24	27
Mattanawcook Lake, Lincoln	2	3	3	5	6	10	7	2	5	5
Penobscot River, Lincoln - Enfield	5	7	12	12	15	--	--	--	--	--
Pushaw Strait, Orono - Old Town	3	5	4	6	7	--	--	--	--	--
Davis-Holbrook Area, Eddington	2	3	5	5	6	2	2	2	3	5
Corinna Stream, Corinna	3	3	6	9	10	4	6	4	12	12
Goose River, Belfast - Swanville	10	6	12	15	12	8	7	12	16	13
Snake Pond, Brooksville	--	--	--	--	--	4	4	6	4	4
Totals	76	94	114	128	137	91	101	121	143	144

WATERFOWL BREEDING GROUND SURVEY IN NEW HAMPSHIRE, 1949 - 1950

Tudor Richards

The waterfowl breeding ground survey is a part of a year-round waterfowl population survey now being carried on by the New Hampshire Fish and Game Department as a Federal Aid study. Information obtained in this survey is for the use of the State Fish and Game Department and the Federal Fish and Wildlife Service in making management plans, especially hunting regulations. It also will provide the basis of a report to be written in popular style for the benefit of sportsmen and other wildlife enthusiasts interested in the waterfowl of New Hampshire.

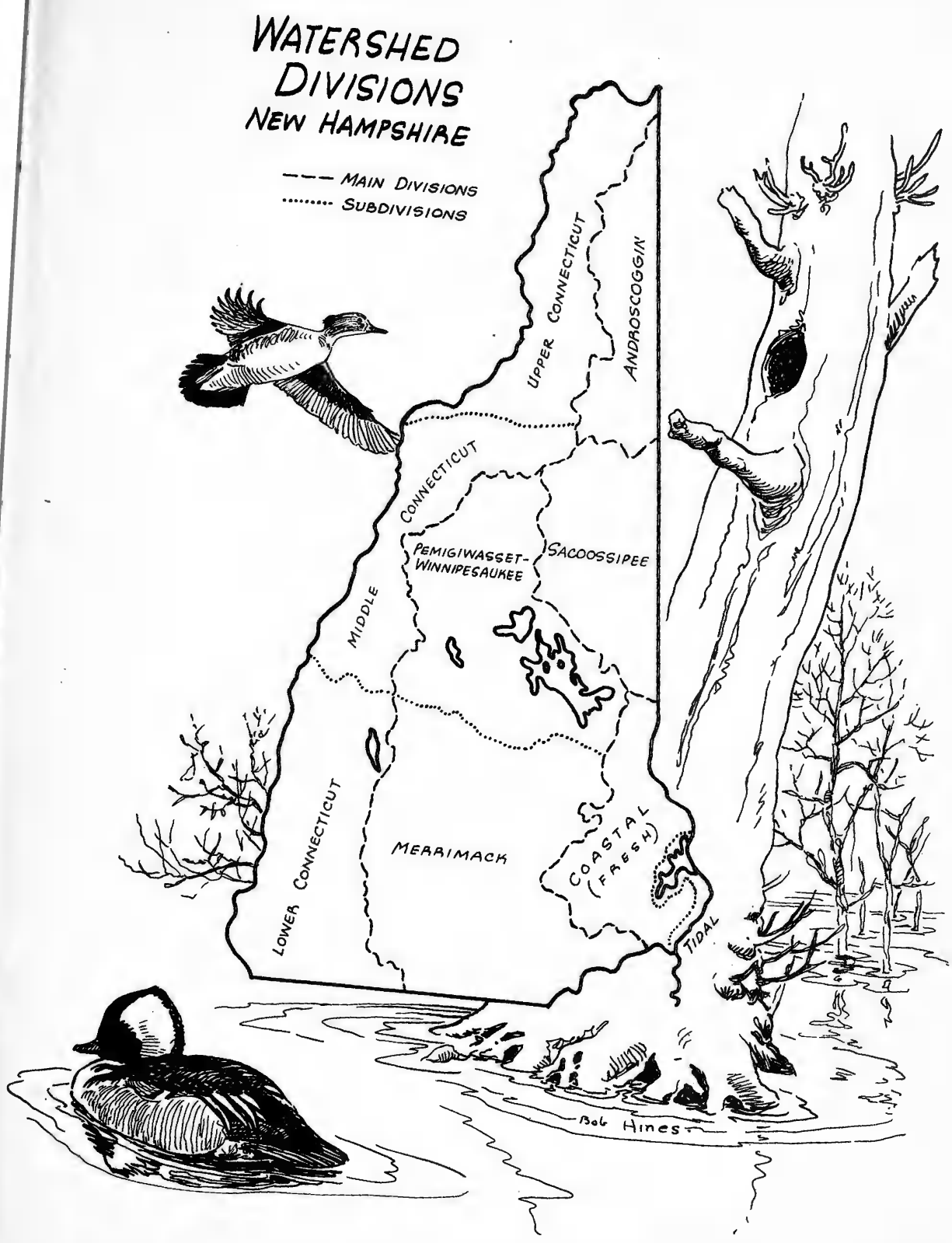
This waterfowl population survey succeeds the waterfowl habitat improvement survey, carried on in the years 1945-1948 inclusive, as the mainstay of PR Project 7-R. The habitat survey consisted of making an inventory of all the waterways of the State to determine their suitability or potential suitability for waterfowl either as breeding grounds or resting spots during the migrations. Some of the information obtained is already being used in the management of waterfowl habitat. Notes were made in the course of the habitat survey on all waterfowl observed, but upon the completion of the field work it became evident that more accurate information on the status of the many species of waterfowl that occur in New Hampshire either as migrants or residents was desirable. Accordingly, the waterfowl population survey was organized in the spring of 1949 and the breeding ground survey as a major part of it the following summer.

In this first summer, one man spent most of June and July and a little of August and September in the field locating duck broods in the majority of the more important waterfowl nesting areas and representative lesser ones in each of nine divisions of the State that have been recognized in the population survey. A considerable number of brood records were contributed by other members of the Fish and Game Department and a few by outside cooperators. A brief report summarizing the results of this survey was submitted as the Quarterly Progress Report of project 7-R-5 in October 1949.

In 1950 the breeding ground survey was continued. As in the previous year, the writer did the major share of the field work, which was carried on intensively on a nearly full-time basis in June, July, and August. Over 100 different waterways were visited, including most of those surveyed in 1949, as well as numerous new ones.

Hilbert Siegler, Fish and Game Biologist, on several occasions helped cover some of the larger areas, as well as a good many lesser areas. Conservation Officer, Fred Scott, covered the more important areas in his Pittsburg territory for the second straight year. Other members of the Fish and Game Department, Mrs. Clinton Wallace in New Hampton, Mr. Kimball Elkins in Andover and Salisbury, Mrs. Ralph Brainard in Walpole, Mr. and Mrs. Bradley Baker in Concord, and students of the University of New Hampshire, under Professor C. F. Jackson, are other contributors to this study.

Methods used in the 1950 survey were very similar to those of the previous year. Emphasis was placed on the location of broods rather than on breeding pairs or nests. Representative water bodies were selected for sampling, and most of these were visited but once in order that as many areas as possible be surveyed. It seemed desirable not only to resurvey the areas visited the previous years, to determine possible trends, but to investigate new areas as to their productivity and suitability as representative types of habitat to sample. The better, larger types of breeding grounds are not typical, nor are there enough of them to provide sufficient volume of statistics


WATERSHED DIVISIONS
NEW HAMPSHIRE
MAIN DIVISIONS
SUBDIVISIONS
UPPER CONNECTICUT
ANDROSCOGGIN
CONNECTICUT
PEMIGIWASSET-WINNIPESAUKEE
SACOOSSIPEE
MIDDLE
LOWER CONNECTICUT
MERRIMACK
COASTAL (FRESH)
TIDAL
Bob Hines

Blank Page Digitally Inserted

themselves. Then too, these better areas with their extensive cover almost invariably have a higher percentage of errors than those more easily surveyed. Finally, it is believed that the majority of the waterfowl produced in New Hampshire come from the many small areas of various kinds such as oxbow ponds, marshy coves in lakes and ponds, beaver ponds, meadow marshes, etc., where from one to several broods are raised; and other things being equal, the more areas visited the more accurate the survey. It does appear now, however, that the best type of survey would be one that calls for visits both in June and August to the representative areas selected for determining trends, leaving July for the investigation of new areas. So far it has been difficult to work in inspections of wood duck boxes at the same time as the brood surveys. Accordingly, only those convenient to check have been checked in the course of the brood survey, the figures being accumulated for a separate report when all boxes have been checked. The methods used in the brood survey are as follows: Each area as it is surveyed is covered in entirety, though high percentages of error must be assumed in the case of the better areas. Actual coverage may be by one of several different methods or a combination. Certain small areas next to a road can sometimes be surveyed from a car, especially with the aid of a small telescope. More often a short walk takes the observer to a spot overlooking the whole area, and occasionally a strategically located tree is the best vantage point. One of our outstanding ponds is next to a railroad junction, and here a railroad car is usually available as a high spot from which to look it over. A canoe, since it is apt to disturb the ducks, is used only as a last resort, though often it is the only practicable way to cover an area.

Of the broods observed by Richards in 1950, 40 percent were first seen from a boat, 27 percent from the ground, 21 percent from an automobile and 12 percent from a tree or railroad car. Quite different were the percentages of the number of COMPLETE broods seen, namely, 42 percent from the ground, 27 percent from a car, 17 percent from a tree or railroad car, and only 14 percent from a boat.

Data Collected

The data collected consist largely of the number of broods and potential broods observed in each of nine regional divisions of New Hampshire. These figures are shown in Table 1 and include totals for 1949 (revised) and 1950, for the areas visited both years and for all areas visited each year. Considerably more areas were visited in 1950. Under broods are included the number of actual broods seen, the number of broods not seen but accounted for by the actions of maternal females and the number of probable broods as indicated by groups of apparently grown-up young ducks. Under potential broods are included all excess adults, not counting drakes, except in cases where more were seen than the number of broods. These figures for potential broods are included because undoubtedly a large share of them represent actual broods, perhaps enough so that the totals including them may be a better measure of production than just the total number of reasonably sure broods. Figures for wood duck box use indicate probably much greater production in certain of the better areas, but are not included because they are as yet very incomplete.

Examination of the figures reveals a striking similarity between those of 1949 and 1950 for the same areas covered. Counting only the combined totals of the broods and the potential broods, the variation is only a little over two percent for the grand total and still only about ten percent in the cases of the black duck and the wood duck.

The latter two figures suggest possible slight decreases and increases respectively. Assuming, however, that they merely indicate chance variation, the sampling methods may well be accurate enough to show what they were intended to show: namely, the approximate relative abundance of the different species and any major trends that might occur. The important findings are that the black duck and the wood duck are common nesting birds practically everywhere in New Hampshire,

with indications at present that the latter is anywhere from one and a half to twice as common as a whole, and except very locally, less common only in the coastal areas.

Among the lesser species only the figures for the golden-eye show much more than a 10 percent change in a year's time. This is very likely because the Androscoggin Valley was not covered until August, by which time the golden-eye families had been broken up and dispersed, making only conservative estimates of the number of families possible. In any case, the golden-eye is a fairly common summer resident of extreme northern New Hampshire, as it apparently has been for years.

The ring-necked duck was first found breeding in New Hampshire in 1947 at Fish Pond, Columbia, in the northern part of the Connecticut River drainage where one brood was located. The next year six broods were discovered on two different ponds in Jefferson, also in the upper Connecticut drainage, but over 30 miles south of the first record. Despite much more intensive searches the last two years, only one new breeding location was found in each year, though that for 1950 was the first in the Androscoggin Valley. A gradual increase may be looked for.

Both mergansers are most common in northern New Hampshire, but are fairly common in the central part of the State. Farther south both species are rare or absent. The figures for the American merganser are no measure of its relative abundance as compared with the other ducks, since the large streams and lakes where it breeds have not been given much attention on the survey thus far. The hooded merganser, like the wood duck, has made a real comeback in recent years and appears to be New Hampshire's third most common nesting duck. One record of a mallard brood was obtained in 1950 near Concord, not far from the Merrimack River. No mallards are known to have been released near here, so the parent birds may not have been feral. This is the first such record for the survey.

No very satisfactory classification of waterways has as yet been worked out for those used by duck broods, but a wide variety of habitat has already been found to be used by black and wood ducks and hooded mergansers. These include the several types of natural ponds, such as typical glacier-formed ponds, bog ponds, oxbow ponds, beaver ponds, as well as artificial ponds, coves in lakes and large and small streams. Extensive marshes are more the exception than the rule, but some sort of marshes occur in a good percentage of each of these types of waterways and are of course the preferred spots for females with young. Perhaps the best types of marsh occur in backwaters of large streams formed by dams, along small winding streams or around boggy ponds. The wood duck appears to like all types of fresh-water marshes as well as the black duck and is more tolerant of non-marshy types of habitat. Habitat of both types has already been made available to more wood ducks through nesting box distribution, which is continuing.

The three remaining species show more preference for certain types of habitat than do the above-mentioned three. The ring-necked duck appears to prefer typical bog pond habitat. The golden-eye does not seem to require or even like ponds that have much marsh. More typical northern ponds as long as there is enough food is what the species prefer. The American merganser is probably most common along the large rivers of the north, but it appears to like large lakes almost as well. Only occasionally is a brood of these species found on a small stream.

Table 3 gives the number of complete broods and the average as well as the maximum number of young per brood for each species for both the years 1949 and 1950. These figures include those from all cooperators. These data indicate that the average brood size for both leading species, especially the wood duck, as well as for the ring-necked duck and the golden-eye, was smaller in 1950 than in 1949.

Table 1. -- Number of Broods and Potential Broods Observed in New Hampshire in 1949 and 1950 Based on Comparable Coverage

SPECIES	UPPER CONN.		MIDDLE CONN.		LOWER CONN.		PEMIGIWASSET		WINNIPESAUKEE		MERRI-MACK		ANDRO-SCOGGIN		SACOOSSIPEE		COASTAL FRESH		COASTAL SALT		TOTAL	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
MALLARD																						
Broods																						
Potential Broods																						
Total																						
BLACK DUCK																						
Broods	8	11	2	3	5	2	7	4	8	11	6	7	2	1	6	1	8	4	52	44		
Potential Broods	2	2	1	1	2	0	1	2	5	1	0	2	1	1	1	1	0	5	13	15		
Total	10	13	3	4	7	2	8	6	13	12	6	9	3	2	7	2	8	9	65	59		
WOOD DUCK																						
Broods	12	12	5	2	7	8	10	14	13	23	11	19	1	4	4	2	-	-	63	84		
Potential Broods	6	2	4	1	5	1	3	1	15	17	1	0	1	2	1	1	-	-	36	25		
Total	18	14	9	3	12	9	13	15	28	40	12	19	2	6	5	3	-	-	99	109		
RINGNECK																						
Broods	11	9	-	-	-	-	-	-	-	-	0	1	-	-	-	-	-	-	11	10		
Potential Broods	1	3	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-	1	3		
Total	12	12	-	-	-	-	-	-	-	-	0	1	-	-	-	-	-	-	12	13		
GOLDEN-EYE																						
Broods	4	7	-	-	-	-	-	-	-	-	13	7	-	-	-	-	-	-	17	14		
Potential Broods	0	0	-	-	-	-	-	-	-	-	2	0	-	-	-	-	-	-	2	0		
Total	4	7	-	-	-	-	-	-	-	-	15	7	-	-	-	-	-	-	19	14		
HOODED MERGANSER																						
Broods	7	5	0	0	1	2	3	5	3	2	15	13	0	0	1	0	0	0	30	27		
Potential Broods	2	0	0	1	0	0	3	1	0	1	0	1	0	0	0	0	0	0	5	4		
Total	9	5	0	1	1	2	6	6	3	3	15	14	0	0	1	0	0	0	35	31		
AMERICAN MERGANSER																						
Broods	0	0	0	0	0	0	3	4	1	0	1	5	1	0	0	0	0	0	6	9		
Potential Broods	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	4	0		
Total	0	0	0	0	0	0	3	4	3	0	3	5	1	0	0	0	0	0	10	9		
Total Broods	42	44	7	5	13	12	23	27	25	36	46	52	4	5	11	3	3	4	179	188		
" Potential Broods	11	7	5	3	7	1	7	4	22	19	5	3	2	3	2	2	0	5	61	47		
NET TOTAL	53	51	12	8	20	13	30	31	47	55	51	55	6	8	13	5	5	9	240	235		

Table 2. — Total Number of Broods and Potential Broods Observed in New Hampshire in 1949 and 1950

SPECIES	UPPER CONN.		MIDDLE CONN.		LOWER CONN.		PEMIGIWASSET		WINNIPESAUKEE		MERRIMACK		ANDROSCOGGIN		SACOOSSIPEE		COASTAL FRESH		COASTAL SALT		TOTAL	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
MALLARD																						
Broods											0	1										1
Potential Broods											0	0										0
Total											0	1										1
BLACK DUCK																						
Broods	12	13	3	6	5	4	7	11	14	22	7	8	2	2	9	3	8	5	67	74		
Potential Broods	2	4	1	5	2	0	3	6	9	4	0	4	1	2	3	2	0	6	21	33		
Total	14	17	4	11	7	4	10	17	23	26	7	12	3	4	12	5	8	11	88	107		
WOOD DUCK																						
Broods	14	15	5	5	9	12	11	25	26	37	14	20	1	13	7	3	-	-	87	130		
Potential Broods	6	2	7	8	8	1	6	9	15	27	1	0	1	7	1	2	-	-	45	56		
Total	20	17	12	13	17	13	17	34	41	64	15	20	2	20	8	5	-	-	132	186		
RINGNECK																						
Broods	11	9	-	-	-	-	-	-	-	-	0	1	-	-	-	-	-	-	11	10		
Potential Broods	1	3	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-	1	3		
Total	12	12	-	-	-	-	-	-	-	-	0	1	-	-	-	-	-	-	12	13		
GOLDEN-EYE																						
Broods	5	8	-	-	-	-	-	-	-	-	13	8	-	-	-	-	-	-	18	16		
Potential Broods	0	0	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	2	1		
Total	5	8	-	-	-	-	-	-	-	-	15	9	-	-	-	-	-	-	20	17		
HOODED MERGANSER																						
Broods	10	6	0	0	1	2	6	5	4	3	15	15	0	1	1	0	0	0	37	32		
Potential Broods	2	1	0	1	0	0	3	2	0	1	0	1	0	0	0	0	0	0	5	6		
Total	12	7	0	1	1	2	9	7	4	4	15	16	0	1	1	0	0	0	42	38		
AMERICAN MERGANSER																						
Broods	2	1	0	1	0	0	3	4	2	0	4	5	1	0	0	0	0	0	12	11		
Potential Broods	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	4	0		
Total	2	1	0	1	0	0	3	4	4	0	6	5	1	0	0	0	0	0	16	11		
Total Broods	54	52	8	12	15	18	27	45	46	62	53	57	4	16	17	6	8	5	232	273		
" Potential Broods	11	10	8	14	10	1	12	17	26	32	5	6	2	9	4	4	0	6	78	99		
NET TOTAL	65	62	16	26	25	19	39	62	72	94	58	63	6	25	21	10	8	11	310	372		

Table 3. - The Number of Complete Broods, the Average Number of Young Per Brood and the Largest Single Brood - By Different Species - for 1949 and 1950

1949

	Black Duck	Wood Duck	Ring-necked Duck	Golden-eye	Hooded Merganser	American Merganser	Total
Number	24	42	11	8	18	9	112
Average	7.125	8.26	6.36	7.25	6.06	10.44	
Largest	15	18	9	11	16	16	

1950

	Black Duck	Wood Duck	Ring-necked Duck	Golden-eye	Hooded Merganser	American Merganser	Total
Number	35	43	9	9	3	7	106
Average	6.69	7.37	4.78	6.22	9.66	9.14	
Largest	11	13	8	10	18	20	

No attempt has yet been made to determine the effects of weather on production. It is expected, however, that some emphasis will be placed on a study of production-weather correlation if it appears to be warranted.

Indexes of total population have not been computed either, but with the accumulation of more data this may be attempted in the future.

Summary

A waterfowl breeding ground survey of New Hampshire was made in the summer of 1950 for the second consecutive year. This is part of year-round waterfowl population study that succeeds the waterfowl habitat improvement survey as the major part of Federal Aid Project 7-R. As in 1949 emphasis was placed on locating duck broods in representative habitat in each of nine regional divisions of the State. Counts of full broods were made wherever possible. One man spent practically full time on the survey, and brood records were also obtained from other members of the Fish and Game Department as well as from outside cooperators. Altogether over one hundred different areas were covered, the majority having also been surveyed in 1949; and 273 brood records were obtained. Wood duck and black duck broods again were found to occur commonly practically throughout the State, and in a wide variety of habitat. Of the two species the wood duck led in total number of broods both years. The third most common species both years was the hooded merganser, which like the American merganser is fairly common in central New Hampshire and even more common farther north. The golden-eye has been found to be continuing as a common summer resident of the extreme northern part of the State. Least common of the regular summer residents is the ring-necked duck, which has been known to nest in New Hampshire only since 1947. In 1949 broods were found on four different ponds in the upper portion of the Connecticut watershed, and in 1950 broods were again found on these same ponds, and on one in the Androscoggin watershed. In 1950 also a mallard brood was found in the Merrimack watershed with no evidence that it belonged to released or escaped birds.

WATERFOWL BREEDING GROUND SURVEY IN DELAWARE - 1950

E. B. Chamberlain

Introduction

So far as is known this is the first year that any attempt has been made to keep track of the waterfowl population throughout the breeding season in this State. This study had three main objectives:

1. To determine the peak and the duration of the spring migration.
2. To determine the resident or breeding population.
3. To determine total number of broods and average size of broods.

The survey was started at the peak of spring migration, which this year was during the last week of March. All of the survey was done by the aerial transect method with the author acting as pilot and two other P-R men, Henry Cofer and Robert Beck, taking turns as observer.

Transects were flown every week until it was evident that migration was over; then they were flown twice a month until the first week in September, when the semi-monthly aerial counts of total population were started.

Methods Used In Sampling, And Area Covered

As already stated, the aerial transect method was used exclusively. This method is too well known to need description here. However, it should be noted that after migration was over it was possible for both pilot and observer to record numbers by species. This is probably somewhat more accurate than applying the percentage of each species seen by the observer to the total counted by the pilot to obtain total numbers of each species.

Seven transects were established. These have a combined length of 64 miles, and are laid out in such a manner that all the important waterfowl producing areas of the State are covered. The location and length of each transect is shown on the accompanying map. While it may seem that these transects are rather short, they contain 16 square miles and constitute a 7.5 percent sample of the waterfowl habitat of the State.

There is not much variation in habitat along any of the transects. Probably the greatest single variable is the gradual change, from north to south, in the salinity of the water. Transect No. 1, covering the Newport Marsh, is essentially fresh in character, while No. 7, running from Rehoboth to the Delaware-Maryland State line, covers water that has a salinity approaching that of the sea. Between these two lie all ranges of salinity. The most waterfowl were found in marshes where natural or man-made barriers have excluded the tide and the vegetation is mainly of the fresh water type. Fortunately, many of the marshes fall into this category.

Data Collected And Their Meaning

Weather and Water Conditions

Throughout the period the weather was essentially normal. Precipitation was very nearly average every month until August when it fell a bit below the average for that month. Water conditions in marshes and potholes were generally favorable. Temperatures were slightly below normal and the growing season was about two weeks later than usual.

Breeding Population Trends

As was previously stated, the peak of migration came during the last week in March. The accompanying graph shows trends in population per square mile for the transects, each bar on the graph representing average population per square mile for all transects. In addition to counting total waterfowl seen, a record was kept of pairs that were assumed to be mated. This record appears in Table 1.

Table 1. -- Number of Pairs Recorded During Spring Period

Date	Number of Pairs (Assumed to be Mated)
March 28	Few pairs seen. These were mostly pintails, probably migrants, and were not counted.
April 21	27
April 27	11
May 2	86
May 9	44
May 17	46
May 24	29
June 14	3
June 28	6

Success of the Season

Since there are no data for previous years it is rather difficult to say how successful the breeding season was. However, from general observations by the technicians in the field it is felt that the season was as good as last year.

The number of broods seen and the average number of young per brood are shown in Table 2. The first brood was seen from the air on May 17. The first flightless bird, a black duck, was seen on July 26 while the first fall migrant, a blue-winged teal, was seen on August 23.

Table 2. -- Results of Aerial brood counts

Date	No. Broods Seen	Total No. Young	Average Young per brood
5/17/50	1	7	
6/14/50	1	13	
6/28/50	3	15	
7/12/50	8	31	
7/26/50	3	24	
8 /9/50	1	9	
8/23/50	1	7	
TOTALS	18	106	5.89

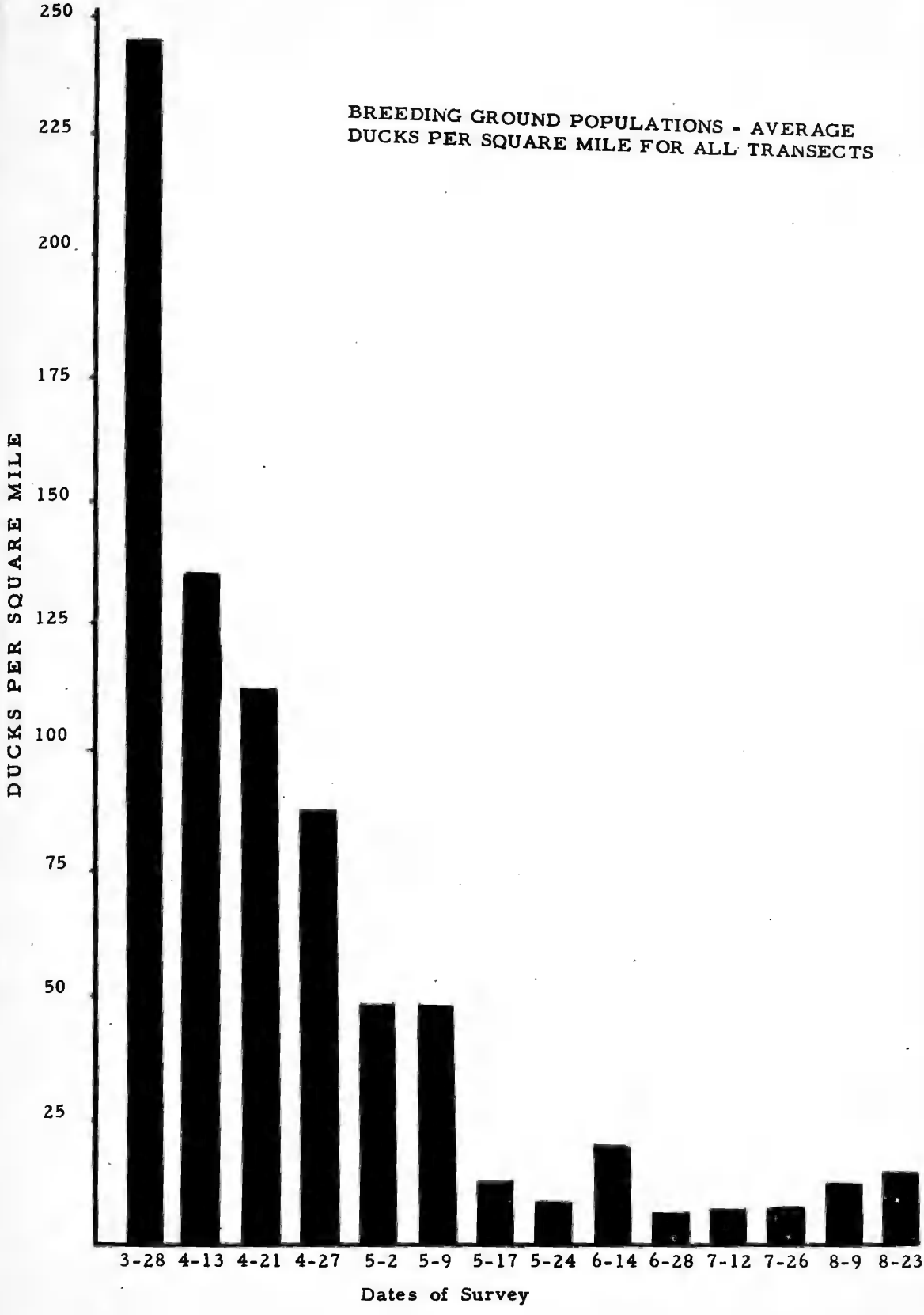

BREEDING GROUND POPULATIONS - AVERAGE
DUCKS PER SQUARE MILE FOR ALL TRANSECTS
DUCKS PER SQUARE MILE
250
225
200
175
150
125
100
75
50
25
3-28
4-13
4-21
4-27
5-2
5-9
5-17
5-24
6-14
6-28
7-12
7-26
8-9
8-23
Dates of Survey

Table 3. -- Date and Percentage Composition, 1950

Species	3/28	4/13	4/21	4/27	5/2	5/9	5/17	5/24	6/14	6/28	7/12	7/26	8/9	8/23
Black duck	72.1	45.7	45.8	52.5	32.7	49.2	76.9	91.7	91.5	70.1	100.0	97.2	96.7	93.6
Teal	11.4	33.5	28.3	42.0	37.8	46.3	16.1	6.9	1.7	25.3				4.0
Mallard	1.9	2.3	4.3	1.8	1.6	0.3	0.5	1.4	5.3				1.9	2.0
Merganser	1.8	3.3	3.8	3.7	2.9	0.1								
Pintail	2.6	0.7	0.3											
Ringneck	0.5													
Canada goose	8.9	11.9	11.6		16.3		3.3							
Bufflehead	0.6													
Baldpate	0.2	2.2	0.2				0.9							
Wood duck		0.4			3.0	1.5	0.9		0.6			2.8		
Shoveler			4.3		5.2	2.6	0.5							
Old-squaw			0.2											
Redhead					0.5									
Gadwall									0.3	4.6				0.4
Coot									0.6					
Unidentified			1.2				0.9						1.4	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

WATERFOWL NESTING SEASON ON NATIONAL WATERFOWL REFUGES - 1950

Richard E. Griffith

The primary characteristic of the 1950 waterfowl breeding season on the national waterfowl refuges was its lateness throughout the country. Late snows and freezing weather caused delayed nesting, and subsequent floods destroyed many nests. The greatest flooding of nests and nesting habitat occurred on the Mud Lake and Upper Mississippi River areas. The wet, cold spring, however, reduced waterfowl production generally throughout the prairie and grain sections of the country. The few exceptions were the Arrowwood, Lacreek, Sand Lake, and Upper Souris Refuges. While the season was late on these areas, the increased precipitation filled potholes that were dry in 1949 and made available additional nesting habitat.

The abnormal weather conditions and their effects on waterfowl breeding are reflected in the specific accounts for the refuges.

Atlantic Flyway

Blackwater, Maryland The nesting season for blacks, mallards, and blue-winged teal was successful. About 15 broods of each were observed and a production of 200 young of each species was estimated. This is a slight increase over the production in 1949.

Bombay Hook, Delaware Species definitely known to have nested are black, mallard, blue-winged teal, and gadwall, with the latter giving heaviest use to Raymond's Pool. The first black duck nest was found on April 8 with the peak of the hatch appearing in early July, a week later than in 1949. The total production, however, decreased 28 percent from that of 1949.

Brigantine, New Jersey Eight broods with 40 young black ducks and one brood of 6 wood ducks were observed on the Brigantine area, which is an increase over the 2 broods of black ducks with 9 young reported for 1949.

Montezuma, New York Conditions were very favorable for nesting, with every small pond having water. There were no extreme fluctuations in water levels that could flood nests. Approximately half the nesting habitat was covered in the brood count survey, which revealed 32 broods with a total of 208 young. It is estimated, however, that about 1000 young ducks were produced on the area. Also, 11 broods of coots were observed and an estimated 250 young produced. This represented a 67 percent decrease in coots over 1949 production. Even the decrease would be appreciable over the 1949 production when it is considered that only half the nesting habitat was covered in the 1950 survey. The first gadwall nest to be found on the refuge was located this year. It contained 9 eggs which hatched between July 27 and August 4.

Central Flyway

Bowdoin, Montana Snow and freezing weather on June 7-8 caused Canada goose nesting losses and a reduction in brood numbers from 175 in 1949 to 92 this season, but the total production of young was only 50 less than the 1949 number of 1,400. There was a decrease of 71 percent in the number of duck broods, however, and only 28 percent of the 1949 number of young produced. On the other hand, the number of coots produced was about double the 1949 figures. All goose habitat and 20 percent of the duck nesting area were covered in the surveys.

Fort Peck, Montana Waterfowl production increased 114 percent over that of 1949 when only 25 young mallards were produced. Among those raised this season were 200 mallards, 75 blue-winged teals, and 25 pintails. Nesting was late.

Fort Peck Easements, Montana All these areas had sharp declines in waterfowl nesting and production due to a cold, wet spring and severe storms during the nesting season. No nests were found on Lake Mason where 83 were found last year. There was no production on Miller Lake. The decreases in production were 88 percent for Lake Mason, 100 percent for Miller Lake, 82 percent for Lamesteer, 75 percent for Half-breed, and 58 percent for Hailstone.

Medicine Lake Montana Approximately the same number of ducks was produced as in 1949, but 9 more Canada geese were produced than the 23 in 1949. This represented a 75 percent coverage of the waterfowl habitat.

Ninepipe and Pable, Montana A late, cold spring and a water level almost 9 feet below the average in May and June were not conducive to a successful waterfowl nesting season. Ten broods of Canada geese with 60 young were observed. Twenty-three broods of ducks were recorded with 245 young. Eight broods of mallards and five of redheads were observed with 100 and 40 young, respectively. The waterfowl production at Ninepipe was about the same as that for 1949. The same water conditions prevailed at Pable. There was no goose nesting. Sixteen broods of ducks with 200 young were observed. This represents only about half the 1949 production when 35 broods with 400 young were recorded.

Red Rock Lakes, Montana Due to the late, cold spring, production of all species of waterfowl decreased from that recorded for 1949. Ice did not leave the lakes until the middle of May. The first broods were not seen until early July. Brood numbers of lesser scaup and blue-winged teal held up fairly well, but ruddy, gadwall, and redhead were especially hard hit. A few Canada geese remained to nest with at least two broods raised, but no young were seen when brood counts were made. The over-all decrease in duck production below the 1949 figures was 51 percent and there was a 62 percent decline in coot production.

Crescent Lake, Nebraska Waterfowl nesting, including coots, for the season was below what normally could be expected. Severe storms through June, July and August contributed to a low ratio of production after unseasonable weather had already delayed nesting activities beyond normal starting time. There was a 15 percent decrease in ducks and 60 percent in coot production from 1949 numbers. More than half of the young ducks produced were blue-winged teal.

Valentine, Nebraska The total waterfowl production showed a 50 percent increase over that for 1949, although coots declined 57 percent. Blue-winged teal is the principal nester with a slight increase over 1949 figures. Late snows disrupted pintail and mallard nesting. The canvasback nested more than average for the past five years, producing 235 young as against 50 for 1949.

Arrowwood, North Dakota Waterfowl nesting was appreciably delayed by late snowfall, but water conditions in potholes and sloughs were the best in many years and contributed to a very successful nesting season that extended into late August. Farmers reported more nests in fields than for several years, but a good many nests were destroyed through farming operations. Blue-winged teal, shoveler, and pintail showed the most increase. Waterfowl as a whole increased 163 percent over 1949 production, and coot numbers increased 650 percent.

Arrowwood Easements, North Dakota A late spring caused a delayed waterfowl hatch, but favorable water conditions contributed to an increase in nesting. An unusually heavy run-off filled hundreds of potholes and sloughs. The areas showing greatest

increase in production were Lake George and Bonehill Creek with blue-winged teal and pintail predominating. The duck production increased 71 percent over the 1949 numbers, while coot increased 165 percent.

Des Lacs, North Dakota Due to the late spring and unfavorable water conditions, waterfowl nesting declined 25 percent and production 40 percent from the 1949 figures.

Long Lake, North Dakota The late, cold spring delayed waterfowl so that any appreciable number of young was not observed until July. Nevertheless, production was up 54 percent over 1949. Last year the mallard showed the highest production, but this season about half the numbers of young counted were blue-winged teal, along with a great many pintail. Coot production increased 100 percent.

Lostwood, North Dakota Unfavorable water conditions and a late spring greatly interferred with waterfowl nesting, which was reflected in a 95 percent decrease in production from 1949.

Lower Souris, North Dakota Figures show nearly 50 percent decline in some species of waterfowl produced and even greater decreases in young of other species. The over-all decrease was 29 percent of the 1949 number. The productions of Canada geese and coots were about the same as last year. The sharp reductions were attributed to abnormally unfavorable spring weather and low water levels in pothole areas.

Slade, North Dakota Waterfowl production was approximately the same as in 1949. Since water conditions were favorable for nesting in surrounding areas, there was no particular influx of birds into the refuge. The nesting season was late. The blue-winged teal produced about 8 times as many young as each of the other species. In 1949 mallard was the greatest producer. The production of mallard, gadwall, pintail, and shoveler was about equal to that for 1949.

Slade Easements, North Dakota Total production of the easement areas was over 50 percent less than in 1949. The decrease is attributed to unfavorable weather conditions, although many ducks evidently were produced on areas adjacent to the easements where potholes were attractive. There is evidence of heavy losses due to farming operations following a late nesting season. The easements:

Appert Lake - A decrease of 71 percent in ducks from 1949.
Canfield Lake - A 69 percent decrease from last year.
Florence Lake - Only 1 brood of 5 pintails produced in 1949.
Hutchison Lake - Although populations and productions were low on other easements, Hutchison showed good duck usage and an increase of 228 percent in duck production over 1949.
Lake Moraine - Heavy grazing by livestock and small amount of water caused a decrease of over 225 percent in duck production from 1949 figures.
Little Lake - Production of waterfowl down 71 percent from 1949 numbers, with a noticeable lack of teal.
Lost Lake - No waterfowl produced on this area in 1949, but 45 young mallards and pintails observed this season.
Springwater - No waterfowl produced this season.
Sunburst - Many ducks were observed in upper reaches of this lake, but production down 30 percent below 1949 numbers.
Wildfang - Only 10 mallards produced this year compared with 25 mallards and 18 blue-winged teals raised in 1949.
Yanktonia - No waterfowl produced this season. (30 raised in 1949).

Upper Souris, North Dakota Despite a late nesting season, which did not get under way until late June, production of ducks fell only 12 percent below that for 1949.

Compared with last year, gadwall production was up 60 percent and the shoveler also increased. There was a sharp decline in numbers of young pintail and reductions were observed in redhead, ruddy, and canvasback. Heaviest production of all species was not observed until after the middle of July. With precipitation above normal, all potholes in surrounding areas were filled and all species found such environment more adaptable for nesting than refuge habitat afforded. The desirable coves, inlets, and marshy impoundments were occupied as in previous seasons, but not so many broods were produced this year. Potholes and sloughs, however, provided nesting habitat in greater abundance and a general increase in young ducks produced was noted throughout this section of North Dakota, particularly on pothole areas in optimum condition.

Lacreek, South Dakota Waterfowl nesting was about the same as in 1949, but the count of young showed an increase of 50 percent over the 1949 production, with a 150 percent increase in coots. Cover conditions were good and the nesting season extended from May 10 to early August with the hatches generally from two to three weeks later than usual. The heaviest nesting was by blue-winged teal, followed in order by gadwall, mallard, and pintail.

Sand Lake, South Dakota Although the season was delayed from 3 to 4 weeks by inclement spring weather, waterfowl nesting was good and increased over 1949. July observations showed fewer broods than normal, but in August more were found than during previous comparable periods. Canada goose numbers were the same as young raised in 1949. Duck production increased 45 percent and coots 25 percent over 1949 numbers.

Waubay, South Dakota Due to the late, cold spring, early nesting of mallard and pintail was mostly unsuccessful. Later nesting was successful. The over-all decrease in duck production was 56 percent of the 1949 figures. Coots decreased 66 percent, but Canada goose production was up 68 percent.

Mississippi Flyway

Union Slough, Iowa There was a 71 percent increase in duck production over 1949 numbers. Nesting was 2 weeks late with the first broods observed in July. Most successful nesting occurred on grazing lands adjacent to pool areas. Mallards and blue-winged teal continued to be the heaviest nesters. Although 117 pintail in 20 broods were produced in 1949, there were no nests this season. Also, there were no baldpates nesting this year, after 15 young being produced in 1949.

Seney, Michigan A decrease of 16 percent in Canada goose production over the 1949 figure was attributed to low brood survival rather than to a decline in breeding population. A decrease of 36 percent in duck production, however, was attributed to smaller breeding populations of ringneck, blue-winged teal, and mergansers than were in evidence during preceding seasons.

Mud Lake, Minnesota Flood conditions were believed to have caused ducks to seek higher ground outside the refuge during the normal nesting season, although farmers reported observing fewer nests than in normal years. As the season progressed with receding flood waters, however, increasing numbers of broods were observed and counts on August 10 revealed that duck production exceeded that for 1949 by 2.5 percent and coots were increased 17.5 percent despite the fact that high water and adverse climatic conditions had retarded the normal nesting period as much as 3 to 4 weeks. Blue-winged teal with 15,000 young showed the greatest increase. Mallards produced 14,000 young. For the first time in recent years green-winged teals were present in limited numbers and 20 young were produced. There was an 80 percent decrease in baldpates and 40 percent in gadwall production,

Rice Lake, Minnesota Despite the late, wet spring, waterfowl production was 62 broods (25 mallards) with a total of 680 young, an increase of 107 percent over 1949.

Tamarac, Minnesota There was an 8 percent decrease in duck production from the 1949 figure. Many ducks seemed to nest but broods did not hatch until July and August, and many did not hatch at all because of the cold, wet season and nest flooding in June. Species nesting were mallard, blue-winged teal, wood duck, ringneck, ruddy, and golden-eye. All except the ringneck produced fewer young than in 1949.

Upper Mississippi, Minnesota The late spring with flood conditions caused a marked reduction in waterfowl production, only 59 percent of the 1949 numbers with less than half the broods counted in 1949. Wood duck nesting on the Keithsburg area was about the same as in 1949, with an increase on the Louisa area attributed to the use of nesting boxes. No successful nesting of mallard and blue-winged teal was accomplished because water levels were too high throughout the season. On the Calhoun and Batchtown areas there was a sharp decline to 42 percent of the 1949 production of waterfowl. Most nesting was done by wood ducks and a few mallards.

Horicon, Wisconsin Nesting ducks in order of importance are mallard, blue-winged teal, wood duck, and black duck. There is no report on weather conditions, but duck production increased 54 percent and coot 131 percent over the 1949 numbers.

Pacific Flyway

Lower Klamath, California The late nesting season caused a reduction of 68 percent in Canada goose production in the number reported in 1949 with a decrease in broods from 45 in 1949 to 23 this season. Late nesting successes, however, increased duck production 27 percent over the numbers reported in 1949. Coot production also improved 23 percent over the 1949 number.

Sacramento, Colusa, and Sutter, California Of several hundred mallards present during the season, only 6 nests and 10 broods were found. The total duck production was estimated to have declined 10 percent from last year at the Sacramento Refuge. One abandoned goose nest with 2 eggs was found. At Sutter Refuge 130 mallards and 20 cinnamon teal were produced. Only 30 mallards were produced on the Colusa Refuge. This represented 8 broods.

Tule Lake, California The late nesting season caused a 77 percent reduction of Canada geese production from the 1949 estimate, there being a decrease in goose broods from 103 in 1949 to 31 this season. On the other hand late nesting success caused an increase of over 51 percent in duck production over 1949 numbers and a 9 percent increase in coots.

Camas, Idaho Nesting did not begin until the middle of June. The broods appeared late but hatch and survival were good. One hundred seventy-nine broods with 899 young were observed. The high vegetation made observations difficult, but it is estimated 25 percent of the broods were seen. A 25 percent decline in total goose production occurred but an increase from 13 to 39 brood numbers was recorded. Production of ducks increased only slightly, 2,962 in 1950 as compared with 2,500 for 1949.

Deer Flat, Snake River, Idaho The resident population of geese was estimated at 35, most of which were non-breeders or breeders whose nests were destroyed by flooding. Only 2 successful nesting pairs were observed and these produced 4 goslings. This is not a suitable waterfowl nesting refuge because of extreme water level fluctuation with a maximum level in April, dropping in May to build up in June, and then dropping rapidly until fall. Nests are thus destroyed by flooding. Nevertheless, thirty-six broods, twenty-four of which were mallards, were observed with 750 young. Also nine broods of coot with 50 young were noted. This compares favorably with the 1949 breeding records when

2 broods of Canada geese with 8 young, 38 broods of waterfowl (30 of mallards) with 680 young, and 2 broods of coots with 10 young were seen.

Ruby Lake, Nevada Despite a generally cold, late season with snow remaining all summer on the Ruby Mountains, 4,176 young of 11 species of waterfowl were produced. Cinnamon teal predominated, followed in order by redhead, canvasback, and mallard. Canada goose production declined only slightly. That of the ducks, however, increased 242 percent over 1949 numbers.

Stillwater, Nevada This new refuge area gives great promise as a waterfowl breeding area. During 1950, the first season under service management, 2,880 nesting pairs, 15 of which were Canada geese were seen. It is estimated that because of the dense emergent vegetation no more than 75 percent of the nestings were observed. These included 650 nesting redheads, 340 cinnamon teal, and 125 gadwall. Counted were 6 broods of Canada geese with 46 goslings, 94 broods of redheads with 2,300 young, and 37 broods of gadwall with 1,335 young. In all, 168 broods of ducks with 5,070 young were recorded. In addition, 5,500 coot were produced.

Malheur, Oregon The season was late, but 3,700 Canada geese, 59,920 ducks, and 30,000 coots were produced. Gadwalls predominated with 35,000. The total count was based on 20 percent coverage of the waterfowl habitat.

Bear River, Utah Based on a coverage of 10 percent of nesting area from ground and air, estimated Canada goose production was the same as in 1949, but duck production was approximately 13 percent less than in 1949. There was the same number (15,000) of coots produced as in 1949.

Little Pend Oreille, Washington Precipitation was 1.25 inches more than for the same period last year, but far below the normal average. Temperature averages were over 6 degrees lower in May than for the same period in 1949. There was no goose nesting. Fourteen broods of ducks with 68 young were observed. This was a slight increase over 1949 records when 10 broods with 57 young were observed.

WOODCOCK CENSUS STUDIES IN NORTHEASTERN UNITED STATES - 1950

Howard L. Mendall

This spring, as in previous years, the writer was assigned the task of coordinating the annual woodcock census studies in the northeastern States and of compiling the resulting data.

Investigations in central and eastern Maine were conducted for the 14th consecutive year by the personnel of the Maine Cooperative Wildlife Research Unit. The writer was assisted in 1950 by Malcolm Coulter, H. L. Kutz, Denis Benson, William Peppard, and Frank Haseltine on the Penobscot County areas; and by Louis Beckett, Arnold Davis, John Dudley, and Jim Rearden on the Washington County areas.

The results of the census studies of the Maine Unit are presented in Table 1.

Beginning in 1945, an increasing number of new census areas have been established throughout the New England States and New York by cooperators who have reported their findings to the Maine Unit for combined tabulations. It is gratifying to note, each year, a larger number of study areas. The names of the individuals participating in the 1950 census are given with the tabulated data. State organization of these cooperator areas has been as follows: for Maine, Howard Mendall, Maine Cooperative Wildlife Research Unit; for New Hampshire, Fred Scott, New Hampshire Fish and Game Department; for the Franklin County areas in Vermont, Ralph Minns, U. S. Fish and Wildlife Service; for all other areas in Vermont, Roger Seamans, Vermont Fish and Game Service; for the Newburyport area in Massachusetts, Russell Norris, U. S. Fish and Wildlife Service; for all other areas in Massachusetts, William Sheldon, Massachusetts Cooperative Wildlife Research Unit; for Connecticut, James Bishop, Connecticut Board of Fisheries and Game; for Long Island, Samuel Miller, U. S. Fish and Wildlife Service; for all other areas in New York, Charles Brown, New York Conservation Commission.

The results of the 1950 census studies on the cooperator areas are shown in Table 2.

Summary

The following tabulation shows, in condensed form, the totals by States on all census areas:

State	1949 Total	1950 Total
Maine	197	211
New Hampshire	12	11
Vermont	117	100
Massachusetts	63	72
Connecticut	53	44
New York	122	134
Grand Total	564	572

From these data it may be concluded that the status of breeding woodcock in northeastern United States was virtually unchanged in 1950 from a year ago, with a very slight gain recorded. Thus, a favorable population trend has been maintained for three consecutive years.

As is usually the case each year, considerable local fluctuation occurred. Throughout eastern Maine as a whole the population showed little change, due largely to the fact that a decrease occurred on the Moosehorn Refuge for the second straight year; it may be that a saturation point has been reached on the portion of the Refuge that was developed for woodcock several years ago. In northern, western, and southern Maine, substantial increases were observed. Massachusetts had an increase on most of the census areas and a very heavy increase at Newburyport; only the Leverett area in Franklin County had fewer birds. In New York, substantial gains occurred in Albany, Rensselaer, Jefferson and Chenango Counties, with the State as a whole presenting a satisfactory outlook. Connecticut's losses were most noticeable in Tolland County. Favorable woodcock populations were found throughout most of Vermont except in Rutland County where a heavy decrease was evident; the State as a whole showed a decrease. New Hampshire recorded a slight loss.

It was of interest to note that, except for Massachusetts and New York - where gains were registered both years - the various State population trends of 1950 showed the reverse of 1949; that is, those States recording increases a year ago had decreases this year, and vice versa. This well illustrates the need for as many census areas as possible in each of the States of the Northeast in order to establish reasonably accurate annual trends.

Table 1. -- Census Studies of Maine Cooperative Wildlife Research Unit

(Central and Eastern Maine)

Area	County	Number of Occupied Singing Grounds													
		1937	'38	'39	'40	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50
Calais and Vic.	Washington	45	53	55	40	33	41	43	53	53	61	61	71	63	62
Edmunds (*)	Washington	...	...	18	...	10	9	10	11	16	13	12	(*) 28	(*) 24	(*) 23
Cooper	Washington	...	...	...	...	9	12	5	10	8	7	7	14	17	18
Alexander	Washington	...	...	...	...	...	...	...	10	7	7	8	7	9	10
Houlton	Aroostook	...	...	...	...	5	6	7	7	8	9	8	9	7	10
Orono	Penobscot	...	...	...	...	8	8	3	6	7	5	7	6	1	3
Alton	Penobscot	...	...	...	...	...	...	...	...	7	10	14	9	8	7
All Areas	...	...	...	...	...	...	...	...	...	...	...	...	144	129	133

(*) In 1948, the Edmunds census area was revised and enlarged by about 40 percent. Although the data for 1948, 1949, and 1950 are comparable, they cannot be accurately compared with the figures for previous years.

Table 2. -- Census Areas Maintained by Cooperators

State	Census Area	County	No. Occupied Singing Grounds						Observer in 1950
			1945	'46	'47	'48	'49	'50	
Me.	New Portland	Somerset		12	6	7	10	10	E. Winter
Me.	Lexington	Somerset	6	5	8	8	9	12	E. Winter
Me.	Salem	Franklin			12	12	11	14	E. Winter
Me.	T4 R10	Piscataquis		4	6	8	6	9	H. Dyer
Me.	Lamoine	Hancock	7	7	5	5	6	8	C. Barrett
Me.	Gardiner	Kennebec	6	7	6	6	8	10	W. Harris
Me.	Togus Pond	Kennebec				4	2	3	D. Dorr
Me.	Cumberland	Cumberland		2	2	4	4	4	L. Brackett
Me.	Jonesboro	Washington				11	12	8	F. Barker
N. H.	Pittsburg	Coos	6	7	5	8	12	11	F. Scott
Vt.	Swanton	Franklin		3	1	9	7	9	R. Minns
Vt.	Highgate	Franklin		3	3	7	6	9	R. Minns
Vt.	Victory #1 Moose River	Essex		21	15	22	21	24	R. Seamans
Vt.	Victory #2	Essex					6	4	R. Seamans
Vt.	Waterford	Essex		5	8	11	13	12	R. Seamans
Vt.	Marshfield	Washington		6	5	6	5	4	R. Seamans
Vt.	Wheelerville	Rutland		5	10	12	17	13	H. Colton
Vt.	Shrewsbury	Rutland		4	4	12	16	4	H. Colton
Vt.	Shorburne	Rutland			4	3	4	2	H. Colton
Vt.	Ripton	Addison		14	13	16	16	14	H. Colton
Vt.	Halifax	Windham		2	5	6	6	5	R. Seamans
Mass.	Newburyport	Essex			15	14	18	24	R. Norris

Table 2. - (continued)

State	Census Area	County	No. Occupied Singing Grounds						Observer in 1950
			1945	'46	'47	'48	'49	'50	
Mass.	Belchertown-Amherst	Hampshire					14	18	W. Sheldon & Assts.
Mass.	Leverett	Franklin					18	16	W. Sheldon & Assts.
Mass.	Shutesbury	Franklin					13	15	W. Sheldon & Assts.
Conn.	Litchfield-Morris	Litchfield	6	8	9	5	8	8	H. Pillsbury
Conn.	E. Hartland	Litchfield & Hartford	7	4	6	0	3	1	A. Lamson
Conn.	Glastonbury I	Hartford		3	2	2	4	4	M. Belden
Conn.	Glastonbury II	Hartford		2	3	4	5	5	M. Belden
Conn.	Branford I	New Haven		3	3	5	4	2	O. Beckley
Conn.	Branford II	New Haven		3	3	3	2	1	O. Beckley
Conn.	Guilford	New Haven		1	3	7	4	6	O. Beckley
Conn.	Eastford	Windham			3	4	6	5	F. McCamey
Conn.	Shenepsit II	Tolland		3	4	4	6	4	M. Belden
Conn.	Shenepsit III	Tolland		1	3	1	3	1	M. Belden
Conn.	Portland I	Middlesex		3	1	3	4	1	M. Arnold
Conn.	Portland II	Middlesex		6	4	7	4	6	M. Arnold
N. Y.	Brookhaven, L.I.	Suffolk				1	3	1	S. Miller
N. Y.	New Hudson	Allegheny				3	8	6	J. Munder
N. Y.	Bethlehem	Albany				7	5	8	R. Smith
N. Y.	Westerlo	Albany				6	6	9	C. Mason
N. Y.	Guilderland-Knox	Albany				7	5	4	R. Carl

Table 2. - (continued)

State	Census Area	County	No. Occupied Singing Grounds						Observer in 1960
			1945	'46	'47	'48	'49	'50	
N. Y.	Poostenkill Valley	Rensselaer					4	8	R. Smith
N. Y.	Mamakating	Sullivan				4	2	3	W. Riordan
N. Y.	Watertown - Adams	Jefferson				4	3	6	F. Morrell
N. Y.	Rodman	Jefferson				1	2	3	S. Northrup
N. Y.	Connecticut Hill	Tompkins					32	30	Cornell Univ. Staff
N. Y.	Dryden	Tompkins				9	3	6	J. Whalen
N. Y.	Indian Lake	Hamilton				8	13	15	C. Brown
N. Y.	Pharsalia	Chenango					3	8	D. Hickok
N. Y.	Lysander	Onondaga				18	23	17	W. Dence
N. Y.	Wilmington	Essex				9	9	10	G. Chase
		Totals - Table 1					129	133	
		Table 2					435	439	
		Grand Total					564	572	(1.4% increase)

WOODCOCK SINGING-GROUND COUNTS IN EASTERN CANADA - 1950

Victor E. F. Solman

Woodcock singing-ground counts have been conducted in eastern Canada for several years between the dates of April 15-20 and May 15-20. During 1950 such counts were made in areas in Ontario, New Brunswick, Prince Edward Island and Nova Scotia.

The counts were made by reliable observers, including officers of the Canadian Wildlife Service, the Wildlife Management Institute, members of the Royal Canadian Mounted Police, officers of Provincial Game Departments, and interested private citizens who cooperated on a voluntary basis.

Ontario

A marked increase in woodcock numbers was recorded in the Ottawa and Kingston areas, while little change was noted in the Toronto and Manitoulin Island areas. The 1950 total number of singing males recorded was 88, compared with 81 in 1949 and a several-year average of 85 for the areas concerned. The cool, backward spring apparently had no detrimental effect on woodcock numbers.

Nova Scotia

An unusual snowstorm began in Nova Scotia on April 7, 1950, and continued intermittently for about a week. This was without parallel in the memory of the oldest residents. Woodcock suffered considerable losses. Dead birds and others too weak to fly were found in several areas after the storm. The number of singing male birds recorded was 46, as compared with 65 in 1949 with a 10-year average of 47 for the 3 areas concerned.

New Brunswick

The unusual snowstorm referred to in the Nova Scotia report also affected conditions over much of New Brunswick and caused some distress among the woodcock population. The total number of singing male birds recorded in 1950 was 109, as compared with 195 in 1949 with an average for several years of 126.

Prince Edward Island

The unusual Easter snowstorm reported in Nova Scotia and New Brunswick also affected Prince Edward Island. The total number of singing male woodcock reported in 1950 was 44, in contrast to 52 in 1949 and a 10-year average of 48.

The following table provides data on numbers of singing male woodcock recorded on the check areas in the four Provinces.

Woodcock Singing-Ground Counts - 1950

Province	Census Area	Numbers of Occupied Singing Grounds 1949	1950	Average	No. of Years	Observer 1950
Ontario	Ottawa (Stittsville)	5	9	7.0	8	V.E.F. Solman & J. S. Tener
	Ottawa (Carp)	4	5	3.8	5	" "
	Ottawa (Vars)	2	8	8.9	8	" "
	Ottawa (Cumberland)	1	2	2.1	8	" "
	Kingston (Cataraqui)	1	1	1	2	G. M. Stirrett
	Kingston (Westbrook)	5	6	5.5	2	" "
	Kingston (Perth Rd)	2	1	1.5	2	" "
	Kingston (Holleford)	2	4	3	2	" "
	Toronto (Camp Borden)	2	9	4	3	A. DeVos and R. D. Ussher
	Toronto (Markham Twp.)	3	0	2	4	C.H.D. Clarke
	Toronto (Concession 5 of Gwillimbury E. and Whitechurch)	8	2	2	4	" "
	Toronto (Siloam)	8	8	8	2	" "
	Manitoulin Island (East Bluff)	10	9	9.5	2	H. Lumsden
	Manitoulin Island (Kawagong Swamp)	18	9	13.5	2	" "
	Manitoulin Island (Indian Point)	6	1	3.5	2	" "
	Manitoulin Island (Poplar)	4	14	9.5	2	" "

Province	Census Area	1949	1950	Average	No. of Years	Observer 1950
Nova Scotia	Wolfville					
	(Area #1)	19	12	14.9	10	R. W. Tufts
	(Area #2)	28	20	18.9	10	" "
	(Area #3)	18	14	13.6	10	" "
Prince Edward Island	Fortune	14	15	11.2	10	S.C. Jenkins & H. Webster
	Avondale	11	10	12.0	3	" "
	French Village	10	10	10.3	10	" "
	Conway	17	9	14.2	10	" "
New Brunswick	Fredericton (Richibucto Road)	9	17	21.7	10	B. S. Wright
	Fredericton (Kingsley Bridge)	13	13	13.7	10	" "
	Fredericton (Charter's Settlement)	18	13	13.1	10	" "
	Moncton (Turtle Creek)	48	34	42.3	3	G. F. Boyer
	Saint John (Tilley Road)	35	15	32	3	" "
	Sackville (Cooksville Rd.)	10	3	5.6	3	" "
	(Mid. Sackville Road)	2	1	2.3	3	" "
	(Rockport Road)	22	4	13.0	2	" "
	Tabusintac (Prince Settlement)	18	9	12.2	10	" "

In summarizing, it is noted that singing male woodcock recorded on check areas in Ontario in 1950 showed an increase of about 10 percent over 1949 and about 7 percent over average conditions, while in the Maritime Provinces the 1950 count showed a decrease of about 35 percent from 1949 and about 10 percent from average conditions. It is probable that the unusual snow conditions during early April were responsible for at least some of the reduction in numbers noted in the Maritime Provinces.

WILSON'S SNIPE SINGING-GROUND COUNTS IN EASTERN CANADA - 1950

Victor E. F. Solman

Trends in Wilson's snipe populations in eastern Canada have been studied for a number of years in connection with woodcock studies. Since male Wilson's snipe perform over a wide area and do not appear to have a specified singing time like woodcock the counts of singing male Wilson's snipe are subject to greater error than those of singing male woodcock.

Ontario

In the Ottawa area a slight decrease (about 17 percent) from the numbers observed in 1949 was noted in 1950, while in the Kingston region the decline was much more pronounced (more than 60 percent).

New Brunswick

Increases were noted in all areas except one part of the Sackville region, the total number recorded being 27 for 1950 compared with 22 for 1949 for the same 5 check areas.

Prince Edward Island

The observer for Prince Edward Island has reported a slight reduction in Wilson's snipe as indicated by the singing ground counts, but has mentioned that in other than the check areas Wilson's snipe appear slightly more abundant than in 1949.

Wilson's Snipe Singing-ground Counts - 1950

Province	Census Area	Number of singing grounds occupied 1949	1950	Average	No. of Years	Observer 1950
Ontario	Ottawa (Stittsville)	4	2	3	2	V.E.F. Solman & J. S. Tener
	Ottawa (Carp)	3	2	2.5	2	" "
	Ottawa (Vars)	4	4	4	2	" "
	Ottawa (Cumberland)	1	2	1.5	2	" "
	Kingston (Cataraqui)	17	6	11.5	2	G. M. Stirrett
	Kingston (Westbrook)	1	3	2	2	" "
	Kingston (Perth Road)	8	0	4	2	" "

Province	Census Area	Number of singing grounds occupied 1949	1950	Average	No. of Years	Observer 1950
Ontario	Kingston (Holleford)	11	3	7	2	G. M. Stirrett
Prince Edward Island	Fortune	12	11	11.7	3	S. C. Jenkins
	Avondale	14	9	8.7	3	" "
	French Village	8	10	7.3	3	" "
	Conway	8	10	6.0	3	" "
New Brunswick	Moncton (Turtle Creek)	0	0	0.7	3	G. F. Boyer
	Sackville (Jollicur Road)	9	13	9.6	3	" "
	Sackville (Mid. Sackville)	4	1	2.2	3	" "
	Sackville (Cookville Road)	9	11	8.6	3	" "
	Tabusintac (Price Settlement Road)	0	2	1.0	3	" "

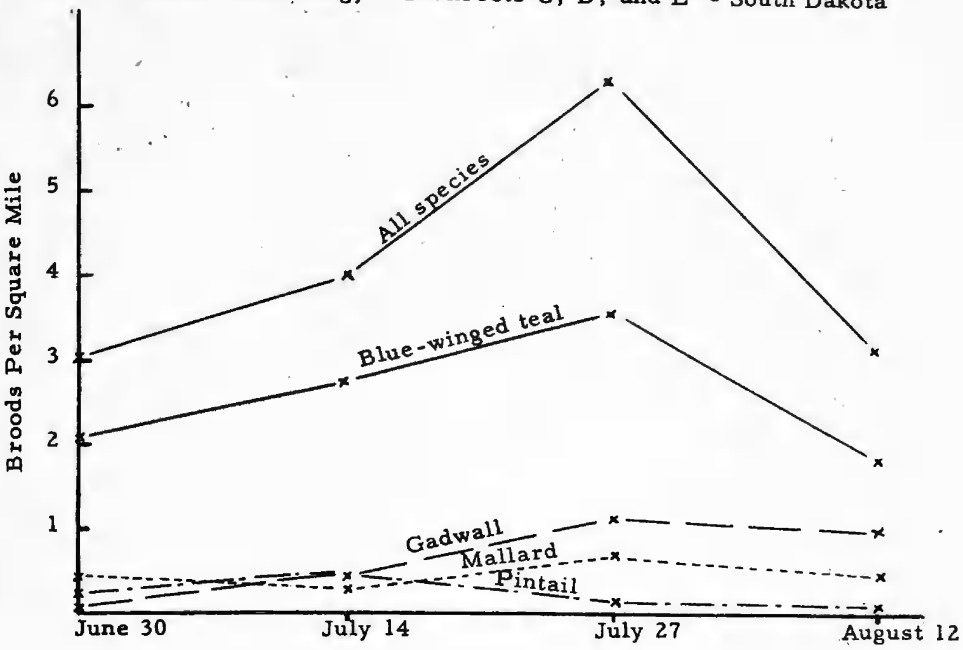
In view of the limited number of counts and check areas involved and in view of the previously mentioned difficulty of obtaining accurate singing-ground counts for this species, it is considered that the Wilson's snipe population, as represented by 1950 singing-ground counts of 89 male birds, is reduced (21 percent) from 1949 when the count was 113 birds on the same check areas, but this reduction may not be significant in regard to the whole of eastern Canada. In view of the apparent reduction in numbers in 1950, no increase in hunting opportunities for this species is considered desirable.

ERRATA

The following section corrects known errors and omissions in the 1949 report. The number on each page points to the proper location of that page in the previous report.

Figure 2

Brood Chronology - Transects C, D, and E - South Dakota



Brood Data by Age Classes - Blue-winged Teal

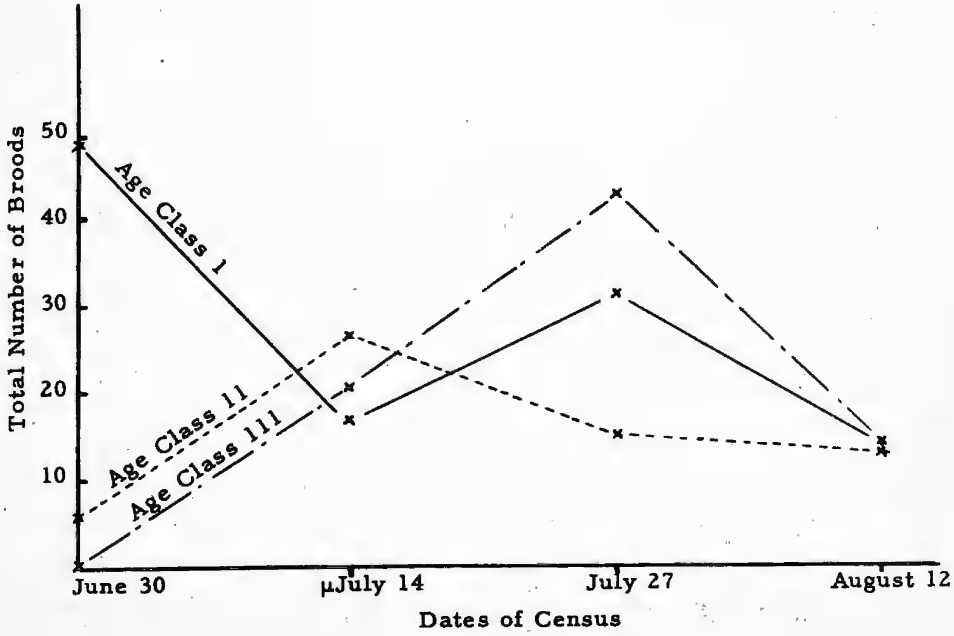


Table 1. — Aerial Flights

	Black	Ring-neck	Golden-eye	Scaup	G-w. teal	B-w. teal	Pintail	Wood	Mallard	Unid.	Geese
New Brunswick											
St. John R. adjacent areas from Woodstock to L. Kennebacasis 8 hours, 20 minutes	1685	318	336	15	16	3	2	14	0	38	6
Lakes and overland transects 11 hours, 10 minutes	186	27	54	-	-	-	-	-	1	4	-
N.B. - N.S. border marshes 1 hour, 15 minutes	103	42	-	-	12	16	31	-	-	5	-
North shore Shediac to Heron Is. 3 hours, 10 minutes	280	6	286	-	-	3	6	-	1	18	2
Total - New Brunswick	2254	393	676	15	28	22	39	14	2	66	8
Gaspe Peninsula											
Gaspe Peninsula, south shore 1 hour, 25 minutes	442	-	1	-	-	-	-	-	-	-	2
Anticosti Island											
South shore 2 hours, 10 minutes	1773	-	395	-	3	-	4	-	-	-	216
North shore (not well covered) 2 hours, 30 minutes	144	4	202	-	-	-	-	-	3	-	19
Lakes and overland transects 2 hours, 25 minutes	2	9	4	-	-	5	-	-	-	4	5
Total - Anticosti Island	1919	13	601	-	3	5	4	-	3	4	240

Table 1. — Aerial Flights (Continued)

	Black	Ring-neck	Golden-eye	Scaup	G-w. teal	B-w. teal	Pintail	Wood	Mallard	Unid.	Geese
Nova Scotia											
Saltmarshes North Shore and Yarmouth 5 hours	1353	1	58	-	5	1	1	-	-	5	20
Fresh Lakes and overland transects 9 hours, 25 minutes	49	13	3	-	-	2	-	-	-	2	8
Total - Nova Scotia	1402	14	61	-	5	3	1	-	-	7	28
Prince Edward Island											
Shoreline East of Malpeque Bay 4 hours, 20 minutes	993	21	120	-	1	1	2	-	1	11	1
Quebec											
North Shore St. Lawrence R. Riviere au Tonnerre to Saguenay R. 4-1/2 hours	189	-	25	-	-	2	-	-	1	14	3
Saguenay R. and L. St. John 2-1/2 hours	68	-	6	-	2	-	1	-	-	-	-
Lake St. Peter 1 hour, 5 minutes	670	-	30	-	3	28	216	1	24	1	1
Lake St. Peter to St. Denis 2-1/2 hours	328	-	33	-	2	1	1	-	1	17	1
Total - Quebec	1255	-	94	-	7	31	218	1	26	32	5
GRAND TOTAL	8265	441	1553	15	44	62	264	15	32	120	284

Table 2. — Summer Brood Survey 1949, Maritime Provinces

Type and Location	Acres Marsh and Water	Miles Shore-line	Black			Ringneck			B-w. teal			G-w. teal			Pintail			Wood			Golden-eye		
			Ad.	Brd.	Av.	Ad.	Brd.	Av.	Ad.	Brd.	Av.	Ad.	Brd.	Av.	Ad.	Brd.	Av.	Ad.	Brd.	Av.	Ad.	Brd.	Av.
FRESH MARSH																							
N.Brunswick	4109	-	343	32	4.9	85	27	7.8	68	10	5.0*	40	5	7.0*	91	36	3.7	77	-	-	31	2	3*
Nova Scotia	392 1/	-	18	5	4.0*	-	-	-	43	16	7.3	12	1	?	-	-	-	-	-	-	-	-	-
Prince E.I.	915	-	85	3	2.0*	19	3	8.0*	7	-	-	13	4	1.0*	15	-	-	-	-	-	-	-	-
FRESH LAKE																							
N.Brunswick	1007	20+	22	3	2.0*	15	4	7.7	-	-	-	3	-	-	1	-	-	15	-	-	-	-	-
Nova Scotia	6501**	58+	37	-	-	21	10	5.0	-	-	-	-	-	-	-	-	-	4	1	4*	-	-	-
Prince E.I.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SALT MARSH																							
N.Brunswick	1900	-	196	13	5.2	-	-	-	-	-	-	62	9	7.0	1	-	-	-	-	-	-	-	-
Nova Scotia	4221	-	156	7	4.8	-	-	-	-	-	-	1	1	6.0*	-	-	-	-	-	-	-	-	-
Prince E.I.	3488	-	299	32	5.9	-	-	-	15	-	-	6	-	-	5	-	-	-	-	-	-	-	-
Total			1156	95	5.3	140	44	7.8	133	26	7.2	137	20	6.8	113	36	3.7	96	1	4	31	2	3

* Based on too few complete broods.

** Seven additional lakes checked from shore with binoculars. Only 6 adult blacks recorded.

1/ Additional data from small miscellaneous areas in N.S.

Blacks	8	Broods	Av. 5.7
Ringneck	2	"	" 8.5
B-w. teal	2	"	" 11.0

Table 3. — Summer Brood Survey 1949, by State Cooperators

State	No. Obs.	No. Areas	Black Ad.	Black Brd.	Black Av.	Wood Ad.	Wood Brd.	Wood Av.	Mallard Ad.	Mallard Brd.	Mallard Av.	B-w. teal Ad.	B-w. teal Brd.	B-w. teal Av.	Gadwall Ad.	Gadwall Brd.	Gadwall Av.	Ringneck Ad.	Ringneck Brd.	Ringneck Av.	Geese Ad.	Geese Brd.	Geese Av.
CONN.	4	38	187	17	4.7	131	34	5.2	11	1	6*	8	1	3*	-	-	-	-	-	-	-	-	-
DEL.	2	6	192	73	4.6	4	4	4*	2	-	-	5	2	3.0*	75	9	7.2	-	-	-	-	-	-
MAINE	6	14	178	47	6.3	39	26	5.3	-	-	-	-	-	-	-	-	-	43	35	6.6	4	1	2*
MD.	2	3	42	30	6.6	1	1	6*	38	24	6.3	47	26	5.0	-	-	-	-	-	-	23	6	3.5*
MASS.	3	7	141	18	5.9	80	23	3.8	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
N.H.	3	21	92	48	7.5	145	65	8.4	-	-	-	-	-	-	-	-	-	26	10	6.3	-	-	-
N.J.	7	9	155	35	8.6	14	13	8.2	2	2	1*	1	1	4*	57	10	6.3	-	-	-	-	-	-
N.Y.	19	16	451	79	7.1	185	62	7.3	326	95	8.3	49	18	9.2	118	43	9.1	11	-	-	-	-	-
PENN.	9	12	184	24	7.2	59	19	6.6	204	33	6.2	2	2	2*	-	-	-	-	-	-	8	1	5*
R.I.	2	2	39	16	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VT.	3	7	707	19	6.0	444	79	7.3	-	-	-	13	6	6.0	-	-	-	-	-	-	-	-	-
Total	60	135	2368	406	6.4	1102	352	6.7	583	155	7.3	126	56	5.9	250	62	7.9	80	45	6.5	35	8	3.5

State	Golden-eye Ad.	Golden-eye Brd.	Golden-eye Av.	H. Merganser Ad.	H. Merganser Brd.	H. Merganser Av.
MAINE	26	16	7.5	9	6	3*
N.H.	19	16	7.2	35	33	5.7
Total	45	32	7.4	44	39	5.3

*Too few complete broods to determine true average.

Interior—Duplicating Section, Washington, D. C. 81245

Blank Page Digitally Inserted

The following Woodcock Reports are out of their proper order in the compilation because they were inadvertently omitted in the initial draft.

NOTES ON THE SPRING WOODCOCK CENSUS IN MINNESOTA, 1950

William H. Marshall

The season in the general area was extremely late, with a 15-inch snowfall on April 24 and additional snowfalls of about three inches on the week following. The area was carefully checked during the week of April 24.

A rather careful survey was made of the Cloquet Experimental Forest Station the week of April 24. It is believed the birds did not arrive there until May 5 or 6. Reports were also received that the birds had arrived 2 weeks previously in the Hinckley country, some 70 miles to the south.

On May 5 the censuses as run in previous years were repeated, with 26 men participating and ideal weather conditions in that it was a clear, warm evening with no wind. Fifteen singing grounds were located on the eastern 600 acres of the Forest. In 1949, there were 24 singing grounds located in the same area. On the entire Forest, 21 singing grounds were located whereas in 1949, 41 were located. This represents a reasonably true picture of the numbers of singing males on the area this spring.

WOODCOCK CENSUS STUDIES IN DELAWARE, MARYLAND, NORTH CAROLINA, NEW JERSEY, PENNSYLVANIA AND WEST VIRGINIA - 1950

P. F. English

The personnel of the Pennsylvania Cooperative Wildlife Research Unit have, since 1939, been conducting "singing ground counts" on two permanent census areas in central Pennsylvania. In 1949 an attempt was made to include in one report the other States listed in the heading but a late start did not give enough time for some States.

A count is included for 1950 from the above-names States. Similar counts over the same areas each year will be valuable in that they will indicate up or down trends.

The following organizations are not cooperating in the woodcock census program for this area:

Board of Game and Fish Commissioners, Dover, Delaware.
Game and Inland Fish Commission, Baltimore 2, Maryland.
Wildlife Resources Commission, Raleigh, North Carolina.
Department of Conservation and Economic Development, Trenton 7, New Jersey.
Pennsylvania Cooperative Wildlife Research Unit, State College, Pennsylvania.
Conservation Commission, Charleston, West Virginia.

The results of the census of 1950 are shown in Table 1.

Table 1. - Census Areas Maintained by Cooperators Report for 1950

State	Census Area	County	No. Occupied Singing Grounds 1949	1950	Observer in 1950
Del.	Petersburg	Kent	-	9	E. B. Chamberlain
Del.	Golts Road	New Castle	-	7	Burd S. McGinnes
Md.	Cove Pt.	Calvert	-	3	V. F. Flyger
Md.	15 Mile Creek Rd.	Allegany	-	3	D. H. Arner
Md.	Green Ridge Rd.	Allegany	-	3	D. H. Arner
Md.	B & O Canal Towpath	Allegany	-	1	D. H. Arner & T. Theurig
N. C.	U. S. #258 to Pleasant Hill	Jones	-	1	R. B. Hazel
N. C.	Falling Creek	Lenoir	-	1	R. B. Hazel
N. C.	Linsley Farm	Martin	-	1	Ben H. James
N. C.	Loray	Iredell	-	1	T. R. Mitchell
N. C.	1 mi. SE Raleigh	Wake	-	3	Donald G. Allison
N. C.	New Hope Farm	Durham	-	1	C. B. Woodhouse & W. L. Hamnet
N. J.	Haleyville Section	Cumberland	7	7	E. G. Beven
N. J.	Harry Daly property	Sussex	4	1	H. W. Lewis
N. J.	Tuckahoe Area	Atlantic	3	3	F. V. Schmidt

Table 1. (continued)

State	Census Area	County	No. Occupied Singing Grounds 1949	1950	Observer in 1950
Pa.	Barrens	Centre	16	16	P. F. English & E. M. English
Pa.	Stone Valley	Huntingdon	15	15	P. F. English & E. M. English
W. Va.	Carl Spring Farm	Preston	-	1	Gordon Hubbard
W. Va.	Kumbrabow Forest	Randolph	9	9	Mr. & Mrs. W. R. DeGarmo
W. Va.	Rt. 52 & CCC Rd.	Tucker	4	6	Hans Uhlig and Mr. & Mrs. H. C. Dahl
W. Va.	1 mi. So. of Bayard	Grant	-	5	Gilpin and Gilpin
W. Va.	Clawson	Pocahontas	-	10	Uhlig, Dahl & Holderby
W. Va.	Henry	Grant	-	5	Robert Kletzly
W. Va.	Leading Creek	Randolph	5	4	W. R. DeGarmo & G. Breiding
W. Va.	Phillips Run	Nicholas	-	4	C. M. Smithson
W. Va.	Sparks	Nicholas	-	1	E. H. Willard, Jr.
W. Va.	Flat Top	Raleigh	-	1	E. M. Pollack
W. Va.	Glen Daniels	-	-	1	E. M. Pollack